Part

B

Section 1: Marbled Murrelet Conservation Plan

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Introduction and Summary

Pacific Lumber (PALCO) seeks an incidental take permit for the marbled murrelet and other species based on the proposed HCP.

The federally listed range of the marbled murrelet extends from Washington State into central California. The Marbled Murrelet Recovery Plan (1997) delineates six Marbled Murrelet Conservation Zones (MMCZ) based on population distribution. The PALCO ownership is in the "Southern Humboldt Bioregion" portion of MMCZ4. (See Figure 9.) A portion of the range of the marbled murrelet has been designated as critical habitat. A 36,973-acre portion of PL's ownership, including Headwaters, is in designated critical habitat. (See Figure 10.) Humboldt Redwoods State Park to the south and State and County parks are also in critical habitat.

The HCP planning area is a total of 219,298 acres, which includes 209,830 acres of PALCO land and 9,468 acres of Elk River Timber Company land subject to the Headwaters purchase and land exchange. With the Headwater purchase, 7,478 acres of the planning area would be under public ownership and 211,820 acres would be in PL ownership.

The HCP proposes establishment of a series of Marbled Murrelet Conservation Areas (MMCAs) for the life of the permit, and take minimization restrictions on many operations elsewhere on PALCO land. Buffer areas are provided for PALCO land adjacent to old growth redwood (OGR) on public land. Areas within 300 feet of OGR is subject to harvest designed to enhance late seral characteristics. Areas within 1/4 mile are subject to seasonal harvest restriction. Figure 1 and Figure 2 show the proposed MMCAs and their names and the 1/4-mile and 300-foot buffer areas. The HCP provides for protection of all MMCAs for the 50-year life of the permit, excepting an option to harvest either the Owl Creek or the Grizzley Creek MMCA.

Many alternative conservation arrangements have been considered throughout the planning process. These alternatives range from configurations conserving only the Headwaters Reserve (approximately 7,500 acres) and harvest of all remaining lands, to those conserving essentially all potentially suitable murrelet habitat timber stands and buffers on PALCO lands (over 21,300 acres) and harvest of none of these lands. (See generally Section 13 maps and tables.)

Alternatives not selected have been rejected following the examinations and analyses undertaken throughout this conservation planning process, because they have been thought to pose too great a short term risk or impact to the murrelet on the one hand, or because they render uneconomic continued harvest management of the private industrial timberland subject to the Plan on the other hand. (See e.g., Comparison of Conservation Plan alternatives – overview, maps and tables – at Section 13 attached, and discussion at 8.b(i) infra.)

On a finer scale, even within the range of practicable alternatives, several MMCA configurations and "trade offs" have been considered. In the end, the conservation strategy selected (Figure 2, see also Section 12) provides the best, least impactive, most practicable, feasible conservation strategy available (see Section 8.b(i)).

With the Headwaters purchase and the delineation of the MMCAs, most (4,322 acres, 84%) of the uncut (unentered, or virgin) old growth redwood (OGR) is set aside from harvest. A substantial amount by area (3,597 acres, 29%) of lower density remnant, or residual trees (remaining in an area after selective harvest) will be available for harvest. The MMCAs, buffers and Headwaters Reserve contain some 17,000 acres in total, including second growth.

The general strategy for the MMCAs is to focus conservation on the larger uncut stands or relatively contiguous uncut-residual old growth stands. MMCA stands are buffered and incorporate second growth to improve habitat geometry and increase connectivity -- both for biological and

management reasons. Much of the buffering second growth timber is already 60'-100' tall and will grow into the adjacent residual and old growth canopy during the permit period. This effectively will improve the habitat quality of the reserved residual timber over time. (See generally Section 12 maps.) The MMCAs protect most (74%) of the uncut, and a majority of the high density residual OGR in critical habitat and add, as one option, the Grizzley Creek complex outside of critical habitat to build on the existing old growth in the state and county park in that separate drainage and extend protection along the Van Duzen River corridor.

Habitat

Most of the uncut and some of the residual OGR on PALCO lands is occupied or potentially occupied by marbled murrelets, and hence harvest may constitute a take of murrelets. One common method to estimate take in an HCP is by estimating the area of habitat lost. The HCP would allow PALCO to plan for harvest of roughly half of the residual OGR on its property. Because the lower density residual is generally believed to be lower quality habitat, it should have a lower probability of occupancy, and its harvest should result in a disproportionately lower estimate of take. Other OGR timber is found on the ownership outside of the area specifically designated as an OGR forest type, but these trees are scattered so that they do not constitute potential habitat for the marbled murrelet, and they are not mapped as OGR forest type.

The majority (96%) of the PALCO residual OGR is in the low density class (under 15 trees per acre). While timber volume may not directly correspond to habitat, it is a further distinction in OGR density. Only 4.1% of the OGR residual set aside under HCP MMCAs have OGR timber density less than 25 thousand board feet per acre (MMBF/ac), whereas 37.7% of the residual available for harvest is in the lowest density class. Assessment of canopy shows that two-thirds of the low density residual -- the class mostly available for harvest -- has less than 25% canopy. (See ***passim*** Section 14 attached, memo and tables to members of the murrelet recovery team, giving a general overview of the murrelet HCP.)

Marbled Murrelet Survey Data

The PALCO ownership has been surveyed for murrelet occupancy from 1991 through 1997. The survey effort for PALCO land has been conducted primarily for the purpose of determining whether a specific stand of old growth or residual could be cleared for harvest. The survey was not conducted uniformly or with a design intended to determine the distribution or density of murrelets on the entire property. Survey in nearby Humboldt Redwoods State Park (HRSP) has been more uniform in design, but less intense and covers fewer years. Figure 5, Figure 6 and 6A all show murrelet survey stations and survey status. (See also maps at Section 12.)

The survey stations are reported as "occupied," present," or "not detected." "Present" indicates that birds were observed, but that occupied behavior, (types of behavior thought to indicate use of a stand for nesting), was not observed.

An OGR stand is deemed "occupied" if, at any survey station in the stand, certain specified behavior indicative of reproduction or nesting is observed one or more times. The occupied station may lie as far as 200 meters (640 feet) from the edge of the OGR due to the need to place stations in areas suitable for observation. The stand is defined as any contiguous OGR, either uncut or residual, with no more than a 100 m gap of unsuitable habitat in the forest cover. Thus, a forest type map alone cannot specifically show contiguity -- that can only be determined in the field.

Pursuant to a protocol designed for the purpose of regulatorily clearing a stand for harvest (Ralph et al 1994), an OGR stand is deemed "not occupied" if it is not contiguous with an occupied station and if there are sufficiently negative survey results. A negative survey means either a minimum of four or more survey days with no murrelet detections or ten or more survey days with only presence detections. More surveys may be required depending on the size of the stand being surveyed. The

determination of habitat suitability and the need for survey reflects qualitative judgment in the field. Survey stations are subject to non-uniform effort.

Impact Estimates

The habitat/take estimate is based in large part on an estimate of the probable area of PALCO ownership that is not occupied, and hence, where harvest would not constitute a take. The projected take of habitat under the HCP depends as well on assumptions of the extent of occupancy of thousands of acres of low density old growth residuals which have not been previously considered to be habitat, and which have received little or no survey effort.

Summarizing a series of analyses, conservative estimates of the loss of OGR allowed under the HCP amount to from 17% to 23% of the occupied habitat in the Southern Humboldt Bioregion. Work done by C.J. Ralph's team at the USDA, Forest Service, Pacific Southwest Research Station, Redwood Sciences Lab (RSL) indicates a lower estimate of take because of distinctly higher relative bird value in the Headwaters and MMCAs than in other areas which would be harvested under the HCP. "Relative bird value" is a measure of habitat value weighted by the number of murrelet detections in certain habitat types. It may well be that there is more concentrated marbled murrelet use in the MMCAs, and there may be more marbled murrelet use in the Humboldt Redwood State Park and the Headwaters Reserve than is assumed, and these conditions would reduce the estimate of habitat take. (See Section 9 and 10.)

The anticipated level of habitat loss from harvest under the HCP on PALCO land is placed in context by Table 4. Table 4 compares area available for harvest with habitat estimates for MMCZ4 and the three state region. Three perspectives are given, the first column shows the gross OGR area, with no estimate of actual area occupied and no relative weighting of uncut and residual. The next two columns give the lower and the higher occupancy weighted estimates. In context, the lower and higher estimates of habitat loss translate to a 2.6% to 3.6% loss of habitat in MMCZ4 and 0.5% to 0.7% loss of habitat in the three-state range. This comparison assumes that all OGR habitat on PALCO land (and in Southern Humboldt) is comparable on an acre-for-acre basis with other, typically non-redwood, habitat elsewhere. As described infra and at the reports and correspondence appended at Section 2, on PALCO lands, murrelets are usually detected in association with OGR and are not usually detected in non-OGR.

Loss of terrestrial nesting habitat may have population impacts, but the nature of the effect is not easily predicted. Different methods may lead to predictions ranging from minimal effect to pronounced effect (see ***infra*** pp. 6-10). The simplest, and the most conservative, assumption is that there is a one-to-one relationship between habitat loss and decline of the corresponding steady-state population at-sea. However, estimating the equivalent number of adult birds corresponding to terrestrial habitat loss is not directly meaningful because it does not mean that this number of birds will be "taken" as individuals.

Mitigation and Monitoring

An extensive mitigation and monitoring program has been provided under this Plan. In summary, in addition to the establishment of the Headwaters Reserve and the MMCAs, buffers and limited use riparian areas provided elsewhere in this Plan, PALCO has proposed mitigation measures including, but not limited to, the following:

- Operational limitations in areas of known active nests;
- Vegetative buffers for suitable murrelet habitat on adjacent public lands;
- Seasonal restrictions on public land buffers;
- Seasonal restrictions on timber falling in selected habitat stands available for harvest; and

· Land use restrictions on existing roads and facilities in MMCAs.

The Company will monitor implementation and effectiveness of this HCP on its lands, on lands transferred as part of the Headwaters Reserve, and on neighboring lands and waters.

Regular monitoring reports will document types, amounts, and locations of forest management activities carried out, seek to document any changes in murrelet populations and changes in the habitat of these populations.

The specific objectives of the conservation program that will guide the effectiveness monitoring process will include:

· maintenance of murrelet nesting activity in occupied stands within the MMCAs

· maintenance or recruitment of nesting activity within the residual stands in the MMCAs

· recruitment of closed canopy, high basal area second growth buffers for residual and old growth stands in the MMCA's

· minimization of new development or activity that could disturb murrelet nesting in MMCA's.

Monitoring associated with the conservation objectives is this Plan is intended to respond to the following research and management questions:

· Are murrelets continuing to use the MMCAs?

· Are murrelets nesting in the MMCAs, and are there indicia of successful reproduction?

· What are the trends in local and regional murrelet populations?

· What is the distribution of habitat in the bioregion?

Methods for monitoring will include the following:

· continuation of inland forest murrelet survey effort in MMCAs

· protection and monitoring of nest success for known active nests

· indirect monitoring of nesting success, using data from offshore surveys, censuses of nest predators during inland surveys, etc.

· continued funding of at-sea monitoring to estimate murrelet population sizes and trends.

Technical Background for Marbled Murrelet Conservation Planning

The PALCO HCP for marbled murrelet is based on information about the terrestrial habitat and old growth redwood on PALCO’s land, terrestrial murrelet surveys, and murrelet surveys at-sea.

Terrestrial habitat information is derived from computer-based forest type mapping maintained by PALCO in a Geographic Information System.

Terrestrial and marine marbled murrelet surveys were conducted and/or compiled by US Forest Service Redwood Sciences Laboratory, Arcata, California.

Data from these sources were analyzed by Thomas Reid Associates (TRA), Palo Alto, California, under direction by the California Resources Agency. The TRA analyses were used by both PALCO and state and federal agencies in developing and assessing the marbled murrelet HCP component. These analyses are summarized in the accompanying sections attached and in the accompanying figures and tables.

1. Marbled Murrelet Habitat Conservation Plan

1.a Purpose

This section describes the long-term conservation strategy for the marbled murrelet and its habitat within the HCP area on the lands of the Pacific Lumber Company ("PALCO"). The conservation strategy protects the highest quality murrelet habitat in the Plan area in perpetuity (in the 7,500 acre Headwaters Reserve), establishes eight other Marbled Murrelet Conservation Areas ("MMCAs") including approximately 8,500 acres of suitable or potential murrelet habitat, provides buffers for such habitat, and provides additional habitat recruitment during the life of the permit (see Figures 1 and 2, see also maps at Section 12 attached). Due to existing uncertainties regarding the status, distribution and population trends of the marbled murrelet in its listed range, the HCP adopts a conservative approach to protect the highest quality murrelet habitat and minimize and mitigate impacts to the murrelet from activities contemplated by the HCP.

Currently, on this industrial timberland, zoned under state law exclusively for timber growth and harvest and compatible uses, murrelet conservation is addressed and limited only by ESA and CESA "take" prohibitions as implemented by the California Forest Practice Rules. By contrast, the conservation strategy described herein is intended to provide a higher level of protection for the marbled murrelet, both during the life of the permit, and by the end of the 50-year permit period. While there will be some short-term loss of mostly lower quality habitat, this is intended to be offset by long-term conservation of the most valuable portions of the existing habitat, reduction in fragmentation of existing habitat, establishment of buffers, and recruitment of additional new habitat. One overall goal of the conservation strategy is to enhance the probability of continued survival of marbled murrelets found in Marbled Murrelet Conservation Zone (MMCZ) 4, designated in the 1997 Recovery Plan, for the species during the next 50 years and, in this manner, contribute to the survival and recovery of the listed species throughout its three-state range. After this time, the best available data indicates that the threat to the survival and recovery of the murrelet could be substantially reduced, both by the existing reserves (State and Federal Parks, Northwest Forest Plan Reserves, Headwaters Reserve), and by growth of habitat on these reserves, and on other state and federal lands.

1.b Effects

The murrelet conservation component of the HCP has been crafted to minimize effects on marbled murrelets, to the extent practicable, while allowing economic timber harvest to proceed on some of the Company's lands. In effect, based on the best available scientific and commercial information and data, PALCO and the state and federal wildlife agencies have negotiated a compromise which strives to reduce conflicts between the goals of private land use and development and endangered species protection. The MMCA strategy and reserve configuration reflects this compromise.

Effects on marbled murrelets are expected due to loss of available, potential or actual nesting habitat. It is not expected that any marbled murrelets will be directly killed by timber harvest activity in the less dense, lower quality habitat slated for harvest, though such "take" could occur outside the MMCA's in the course of timber operations, and indirect effects could occur as a result of the short-term habitat loss. As described below in more detail, the loss of potential or actual habitat through harvest is estimated to be very low as a percentage of the available habitat on the Company's lands (as a worst case scenario 17% - 23%), much lower as a percentage of habitat available to the population in Marbled Murrelet recovery Zone 4 (2.6% - 3.6%), and lower yet as a proportion of the habitat throughout the listed range of the murrelet in California, Oregon and Washington (0.5% - 0.7%). (See discussion infra.) This short-term loss of habitat is offset by the increased conservation protection afforded to a large majority of current habitat, the establishment of buffers adjacent to this habitat, and the development of additional habitat value in both conservation areas and buffers during the life of the HCP. (See generally Volume V, Map 26.).

The overall effect of the HCP on the marbled murrelet is to protect in perpetuity the most important murrelet habitat on the Company's lands (the Headwaters Reserve), and to protect a large majority of high quality habitat on Company lands and to enhance the probability of survival of the murrelet for the next 50 years.

1.c Impact Estimates: Take Evaluation

For purposes of creating this Plan, a marbled murrelet science program was organized and staffed by Sustainable Ecosystems Institute, which arranged for an independent science review panel. Panel members were selected by SEI staff (see Section 7 attached). Scientific investigations of marbled murrelet biology were carried out by independent scientists. (See e.g., Sections 3, 4, 5, 6, 7, 9, 10, 11.) The review panel provided advice and guidance to the scientists carrying out the analyses, and recommended additional analyses. The panel also made recommendations regarding research needs. The Company provided the funding for these analyses, but did not direct or otherwise control the panel activities or recommendations. The list of panel members and the minutes of the many meetings and workshops of the advisory panel are appended at Section 7.

Evaluation of incidental take expected from implementation of this Plan is based in large part on estimates of the probable area of PALCO's ownership that is (1) not occupied or unlikely to be occupied by murrelets, and hence, where harvest would not constitute take; and (2) is either occupied or of such character and quality as to be considered likely to be occupied, and hence, where harvest will remove habitat and may constitute take.

Exact calculation of potential habitat loss is difficult, given the uncertainties associated with murrelet ecology. Several methods of calculating habitat loss are possible, depending on alternative assumptions regarding murrelet ecology in northern California. Two substantive areas of debate have been identified.

1. The amount of marbled murrelet habitat in the bioregion that is already preserved on existing and planned reserves (e.g., Headwaters Reserve, Humboldt Redwoods State Park (HRSP), Grizzley Creek State Park, other parks and preserves).

2. The metric to be used to calculate murrelet use or density in a stand.

The first area of debate has been extensively discussed by many scientists, at several of the murrelet review panel meetings. At the second panel meeting (see Section 7), consensus appeared to be that the amount of habitat on HRSP was at least 5,000 acres, and could be as much as 15,000 acres. However, it was also noted that most murrelets were seen in the alluvial old growth of the Bull Creek drainage bottom. The Headwaters Reserve contains at least 3,000 acres of suitable habitat, and approximately 7,500 total acres.

The second area of debate was also extensively discussed. At the third panel meeting (Section 7), alternative approaches were laid out, and recommendations were made for tests of underlying assumptions.

Alternative metrics to calculate marbled murrelet habitat use:

Three main approaches have been discussed, with additional alternatives based on adjustments to the main methods. These three methods were:

1. Data on occupancy of habitat types, quantified by number of all murrelet detections by USDA, Forest Service, Redwood Sciences Laboratory (RSL-presence approach).

2. Data on occupancy of habitat types, quantified by number of occupied detections on a stand by stand basis (Relative Bird Value or RBV approach).

3. Data on acreage of presumed major habitat types (acreage only approach or AOA).

1. RSL-Presence. The first approach (RSL-presence) has been used previously by Redwood Science Lab (RSL) in habitat conservation planning developed for Arcata Redwood Company, in habitat to the north of Pacific Lumber Company holdings nearer Redwood National Park. The essential elements of this method are that the marbled murrelets in the area are "allocated" to particular forest stands on the basis of the number of detections seen in those stands. This approach is a simple development of standard bird survey methodology, where the number of detections of a species is believed to reflect the density of the species in the area. These density estimates can then be used to estimate the relative proportion of birds in reserve or non-reserve areas. (See Section 9 Draft Report: "Methods of Determining Marbled Murrelet Use of the Southern Humboldt Bioregion" by Ralph, Miller, et al. 10/27/1997 for methodology, assumptions and discussion.)

The RSL-presence approach was discussed at the third panel meeting (Section 7). Important criticisms were that, although the method was based on similar methods for other species, it assumed that murrelets could be evaluated in the same way as those other species. Given the presumed sociality of the birds, and the possibility that birds could be counted several times, it was thought this assumption could result in over-estimates of birds in some areas. More importantly, murrelet detections are thought to occur in non-nesting habitat. "Occupied behaviors," a subset of all presence detections, are thought to be the best indicator of reproductive activity and, hence, nesting habitat. The panel recommended that the RSL-presence method not be relied upon as the sole source for habitat conservation planning, and that whatever metric was used, it should be based on "occupancy" rather than "presence." In any event, this method produced results little different from the RBV approach. (See, e.g., Sections 9 and 10, described below.)

2. RBV. Other metrics were discussed at the third panel meeting. One of these, the RBV approach, essentially allocated murrelets to stands on the basis of occupied behaviors. Section 10 contains the preliminary results of an updated RBV analysis, dated June 5, 1998, by Ralph and Miller, et al. This updated analysis is adjusted to more closely correlate with the MMCA stands which are integral to the conservation strategy provided under this Plan. Section 10 includes an introductory description of the updated report and preliminary results, as well as a Method 1 Summary Table, listing the regional murrelet habitat timber stand names as employed by RSL in its October, 1997, draft report (RSL stands) and the corresponding names of the PALCO MMCAs they contain. Two lengthy tables follow, ranking RBV of the stands using both all detections (presence) and "occupied" detections only. Finally, Section 10 concludes with a table and graphic representation of a comparison of "occupied" versus "presence" detection methods. Briefly, the RBV method allocates the vast majority of murrelets in the bioregion to park and reserve stands.

The method determined the relative number of birds in different habitat areas, as with the RSL-presence method. This RBV method -- as perhaps all methods discussed -- is based on some untested assumptions. In particular, the assumption that murrelets were detected with equal ease in different habitat types could potentially alter the results of this method. Given this uncertainty, the panel recommended evaluation of this assumption by an outside expert. Dr. G. White (Colorado State University) carried out the analysis (see Section 11). In summary, although there was variation in the probability of detection of occupied behaviors in different habitat types, it was thought that this variation would have little effect (1% or less) on the allocation of birds to forest habitats. While this HCP is not predicated on the RBV approach, it appears well supported by the analysis, and is further indicia that the acreage only approach may significantly overestimate take.

3. AOA. The third method, the acreage only approach (AOA), is based not on occupancy data, but on the distribution of habitat types. Under this approach, data on the use of habitats by murrelets is not taken into account mathematically. Instead, a qualitative decision is made on the types of habitat used, or potentially used, by murrelets. The amounts of habitat of these types are

then tallied for different reserve classes. The important assumptions of this approach regard the types of habitat that are selected for inclusion in reserve groupings. Many alternatives are possible under the AOA method using varying assumptions. Using the acreage approach and summarizing a series of analyses, we estimate that harvest of industrial redwood timberland outside the reserves and MMCAs, as allowed under this Plan, could remove between 17% and 23% of the suitable, potentially occupied murrelet habitat in the Southern Humboldt Bioregion. This estimate is heavily influenced by several factors intended to facilitate this analysis and build-in a precautionary margin of of safety. First, and foremost, it is acreage-based. Acreage comprised of widely spaced, low density, low crown and canopy-closure residual old redwood trees obviously has much lower habitat value, and is less likely to be used by murrelets, than equivalent acreage of closed canopy, unentered old growth redwood (OGR). The factors and assumptions which lead to the higher and lower range of estimates detailed here are explained on Table 4.

At the third and fourth panel meetings, there was extensive discussion of some of these metrics and assumptions (Section 7). In particular, it was clear that the calculated effect of the HCP depended critically on the metrics used. The RBV approach, which used the number of occupied detections in an area to determine the relative importance of a forest stand, resulted in the lowest estimate of effect on murrelets under this HCP. This result came about because several proposed reserves (notably Headwaters, Allen Creek, and Bell Lawrence) had high numbers of detections of occupied behaviors, while potential harvest areas (such as Owl Creek) had low numbers of occupied detections (see, e.g., Section 9 and 10).

In this HCP, the acreage only approach (AOA) was emphasized. This method is the most conservative of the available metrics. Although Dr. G. White's analysis (Section 11) supports the assumption that detection of occupancy will not vary significantly across habitat types, and hence validates application of less conservative methods, there is as yet no consensus, and the Scientific Advisory Panel recommended that the most conservative metric be used. In this way, the HCP will plan for a "worst case" scenario in all methods employed; "take" estimates range from a minimum of approximately 17% of the habitat in the bioregion to a maximum of about 23%, depending upon assumptions and techniques employed. All the available tables, data and analyses and assumptions are presented in the attachments included at Section 14, and as elsewhere indicated.

The anticipated level of habitat loss from harvest under the HCP on PALCO land is placed in context by Table 4. Table 4 compares area available for harvest with habitat estimates for MMCZ4 and the three state region. Three perspectives are given; the first column shows the gross OGR area, with no estimate of actual area occupied and no relative weighting of uncut and residual. The next two columns give the lower and the higher occupancy weighted estimates. In context, the lower and higher estimates of habitat loss translate to a 2.6% to 3.6% loss of habitat in MMCZ4 and 0.5% to 0.7% loss of habitat in the three-state range. This comparison assumes that all OGR habitat on PALCO land (and in Southern Humboldt) is comparable on an acre-for-acre basis with other, typically non-redwood, habitat elsewhere. As described infra and at the reports and correspondence appended at Section 2, on PALCO lands, murrelets are usually detected in association with OGR and are not usually detected in non-OGR.

2. Biological Information on the Marbled Murrelet

2.a Overview

The marbled murrelet (***Brachyramphus marmoratus)*** is a small diving seabird that breeds along the Pacific coast of North America from the Aleutian Archipelago and southern Alaska south to central California. In California, Oregon and Washington, it forages in the nearshore marine environment, but flies inland to nest in mature conifers. While nesting is believed to occur more than fifty miles from the coast, most nesting habitat likely occurs within fifty miles. (See generally, U.S. Fish and Wildlife Service, 1997 Recovery Plan for the Threatened Marbled Murrelet in Washington, Oregon and California, Portland, Oregon, 203pp., hereafter "Recovery Plan.")

The Washington, Oregon, and California population segment of the marbled murrelet was federally listed as "threatened" on October 1, 1992 (57 Fed.Reg. 45328-45337) due to several factors including (i) the high rate of nesting habitat loss, (ii) poor reproductive success believed to be due to in large part to vulnerability of nests to predators in fragmented habitat, and (iii) mortality associated with net fisheries and oil spills. The Fish and Wildlife Service designated critical habitat for the murrelet on May 24, 1996 (61 Fed.Reg. 26256-26320). Designated critical habitat includes approximately 3.9 million acres. (Recovery Plan p. A-1, see discussion infra.) The species was state-listed in 1991 as endangered in California under the California Endangered Species Act (CESA); it was listed as threatened in Washington, and threatened in Oregon. Canada has also listed the marbled murrelet as a threatened species. The murrelet is not listed in Alaska.

2.b Habitat Associations and Nesting Behavior

As noted, the marbled murrelet is a small seabird that, in the southern part of its distribution, nests in forests. Unusually for an alcid, it makes no nest, and lays its single egg on a side-branch or other nesting platform (Nelson and Hamer 1995). Estimates of habitat reduction in coastal old growth redwood in northern California range from 85 to 96% from presumed, pre-colonial or prehistoric levels of distribution (Green 1985; Fox 1988; Larsen 1991). This same habitat has also been fragmented, further degrading the suitability of the remaining habitat.

The current distribution of the marbled murrelet in California reflects the remaining distribution of old growth coastal redwood (Carter and Erickson 1992). There is a large break in the distribution between Humboldt and San Mateo counties. Most of this largely unpopulated section (e.g. Mendocino County) at one time may have been marbled murrelet habitat prior to extensive logging (Carter and Erickson 1988; Paton and Ralph 1988). Very few marbled murrelets are found in this area today.

The marbled murrelet nesting season varies in length by season and by starting and ending dates in different parts of its range. Hamer and Nelson (1995a) constructed nesting chronologies on data available to that time. In California, they estimated that the breeding season lasted approximately 170 days, with incubation beginning at earliest on 24 March, and the last chick leaving the nest on September 9.

Murrelets have been observed to lay one egg per nesting attempt. Incubation lasts 27- 28 days (Sealy 1974, 1975; Simmons 1980). Both parents share incubation responsibilities, with one brooding while the other forages. Incubation shifts may last up to 24 hours. Murrelets may occasionally leave their eggs unattended (Hamer and Nelson 1995a). Marbled murrelet chicks are inactive for most of the time they are on the nest. This may be an adaptation to avoid detection by predators.

Marbled murrelets have distinctive flight behaviors in presumed nesting stands. Such "occupied behaviors" include all sub-canopy behaviors, notably landing in trees, and flying through the canopy. Occasionally such behaviors may be seen in non-nesting stands. Such birds may be prospecting or en route to nesting stands. However, "occupied behaviors" remain the best available indicator that a stand is being used for nesting (although not all such "occupied stands" are in fact used for nesting in any one year).

Relatively few marbled murrelet nests have been found to date, primarily because of the difficulties in locating nests high in trees, and in detecting such small, fast-flying and crepuscular birds. The Marbled Murrelet Recovery Plan reports on 136 tree nests found to 1996. Of these 136, 14 were reported from California. Hamer and Nelson (1995) report on the characteristics of these nests. Much of our information on the species is therefore from areas outside the current planning area. (See Recovery Plan Tables 2-3, pp. 33-38.)

Hamer and Nelson (1995b) compiled information on nesting stands used by marbled murrelets: Shown are means (ranges) for important habitat variables. The largest branch width at the nest is

31.9 inches; the smallest 3.9 inches (Hamer and Nelson 1995b). Throughout the range, nest platforms were formed by large primary branches (32%), forks of branches (23%), juncture of branches and the trunk (18%), dwarf mistletoe brooms (9%), and other structures (11%).

	California	Pacific Northwest
N	10	45
Aspect (degrees)	210 (45-352)	166 (35-360)
Elevation (m)	286 (45-46 [sic])	1089 (46-3599)
Slope (percent)	18 (0-41)	23 (0-87)
Stand size (acres)	871 (248-2725)	510 (7 - 2725)
Tree density (No/Acre)	95 (37-208)	73 (19 -214)
Canopy closure (percent)	39 (25-48)	49 (12-99)
Distant to coast (miles)	8 (3 – 17)	10 (1-25)

Nest trees were also characterized:

	California	Pacific Northwest
N	10	47
Tree diameter (inches)	110 (55-210)	83 (35-210)
Tree height (feet)	240 (200-282)	217 (98-282)
Branch diameter at nest (inches)	14 (8-24)	13 (4-32)
Nest platform width (inches)	6 (2-9)	9 (3- 20)
Nest platform moss depth (inches)	1 (0.3-3)	9 (3 -20)
Canopy closure above nest (percent)	90 (5-100)	85 (5-100)

Although in treeless areas in Alaska, murrelet nests have been located on rocky surfaces, in Washington, Oregon, and California the marbled murrelet uses forests with old growth characteristics, generally within 50 miles of the ocean. In California, most nests, and most murrelet detections have been closer to the ocean (Recovery Plan p. 32). Most but not all nests have been found in old growth trees: a minority of nests in Oregon have been found on trees with platforms caused by mistletoe or other deformities (Recovery Plan p.41). The essential component of nesting habitat appears to be a "platform," large enough, or otherwise adequate upon which an egg may be deposited. Moss or other covering, or a depression in the branch may make the limb more suitable. Most tree-limb nests are found on limbs 11 inches or greater in diameter. Availability and abundance of such platforms appear to be the best predictors of murrelet presence and occupancy. (Hamer and Nelson 1995.)

In California, most detections and nests have been found in old growth redwood and partially harvested ("Residual") redwood, although there may be occasional use of Douglas-fir stands. The Six Rivers National Forest, (close to the Company lands) has been surveyed extensively over the past several years. Although having apparently suitable nesting habitat (mature Douglas-fir with platforms) murrelets are seldom if ever seen in the Six Rivers National Forest, suggesting that in the bioregion nesting is essentially restricted to redwoods. On Pacific Lumber lands, murrelets are usually detected only in redwood or mixed redwood/Douglas-fir forest stands. Old growth Douglas-fir elsewhere on Pacific Lumber lands (Bear-Mattole Watershed Assessment Area) does not appear to be occupied by marbled murrelets, possibly because of very inhospitable prevailing weather conditions offshore of this area and due to the highly fragmented nature of the late seral Douglas-fir timber stands, where sparse canopy and harsh microhabitats predominate. (See Section 2 Bear River Study.).

Miller and Ralph (1995) reported on habitat use in Redwoods National Park, and Humboldt Redwoods State Park. They showed that murrelet detection rates were higher in stands with higher old growth crown cover, and with redwood as the dominant tree species. Detection rates were also

higher at lower elevations, in the major drainages of large Park stands. These patterns are essentially similar to the distribution of marbled murrelets on Pacific Lumber lands (see for example ***passim***, Section 9 "Determining Marbled Murrelet Use of the Southern Humboldt Bioregion.")

There is some evidence that stand size affects habitat suitability. Miller and Ralph (1995) showed that marbled murrelet detection rates in California redwood varied with stand size, with larger stands having a higher occupied detection rate. However these results were not statistically significant. Other authors have suggested that small, isolated nesting stands may attract predators and are therefore less attractive to murrelets (Nelson and Hamer 1995; see also Marzluff et al 1998). In other parts of the species' range, there is some evidence that larger stands are more likely to be occupied (Raphael et al 1995).

Although the best available scientific evidence is that marbled murrelets are primarily associated with old growth forest, they have been found in other stand types. Small fragments of old growth, residual stands with a few large trees, and stands with deformities (e.g. mistletoe) have all been used in the southern part of the species' range. Hence, although preservation of old growth may be key to the conservation of the marbled murrelet's habitat, some of the population may also be dependent on forests other than large old growth stands. The essential component appears to be the abundance of suitable nesting platforms (Hamer and Nelson 1995; Kuletz et al 1995).

Some authors suggest that marbled murrelets require interior forest conditions. Hamer and Nelson (1995) showed that successful nests were often further from forest edges than unsuccessful nests (however their sample size is too small for adequate statistical treatment). Such patterns of nest distribution and success could be caused by several factors, notably predation, and availability of nesting platforms with moss or other material (less likely to accumulate at edges). Whatever the causes, these observations suggest that large blocks of habitat may be more valuable for marbled murrelet conservation than smaller habitat areas with extensive edges.

As part of the preparation work for this component of the Plan, surveys for marbled murrelets were carried out on Company lands, and on adjacent Park habitat. These surveys largely confirmed the findings of Miller and Ralph 1995, in that marbled murrelets were concentrated in larger redwood stands with significant old growth components. Figure 3 depicts the distribution of uncut and residual old growth redwood on Pacific Lumber Company lands, with the MMCA configurations superimposed. Figure 4 provides an enlarged view of this same distribution. Figure 5 demonstrates the results of murrelet surveys undertaken throughout the plan area over the last 5 years, and Figure 6 presents an enlargement of these details.

There has been extensive discussion and debate on the most appropriate method for determining the areas with highest murrelet density. This HCP is developed using some of the most conservative of the available methods of allocating marbled murrelets to stands. In keeping with a precautionary approach, the Plan assumes that the majority of marbled murrelet habitat in southern Humboldt County is on Company lands.

2.c Population Sizes and Trends

The original population size of marbled murrelets in California is unknown. Based on extrapolation from forest history, Larsen (1991) suggested an original population of at least 60,000. Sowls et al (1980) and Carter and Erickson (1992) suggest a current population of between 1,650 and 2,000 breeding birds. However more recent estimates, based on extensive offshore surveys, estimate the California population at approximately 6,000 birds (Ralph and Miller 1995). In 1997, a workshop on population biology of the Marbled Murrelet was held to identify reasonable ranges of population numbers in the northern California region with which to conduct sensitivity analysis modeling (see Section 2 attached).

Due to the lack of information on initial population size, most conservation biologists have instead assessed marbled murrelet populations in terms of trends and productivity. In both cases, the raw

data for estimates of population health are derived from at-sea surveys. Surveys in terrestrial habitat, using either human observers, or more recently radar, have only limited utility in determining population trends. This is because it is unknown whether the number of detections of marbled murrelets (when those detections can be reliably distinguished from other birds at any given site) is related to the number of birds nesting there (nesting birds may be silent, and harder to detect).

The overall population size of the marbled murrelet in its listed range is similarly unknown. Ralph et al (1995) provide the most recent estimates, based on at-sea surveys from boats and airplanes. Assessment of the effect of management plans may be determined from presumed effects on Murrelet abundance, or, indirectly, through effects on available habitat. It is currently estimated that some 700,000 acres of suitable habitat remain in the listed range of the Marbled Murrelet (Washington, Oregon and California), a large majority of which is permanently protected on federal lands (see generally Recovery Plan 1997)

2.c(i) At-Sea Surveys

The most widespread technique for monitoring the abundance and distribution of marbled murrelets is to carry out line transects from small boats at fixed distances from shore (see Ralph et al 1995 and references therein). Airplane surveys have some value in determining distribution and relative abundance, but these are less accurate for determining population numbers (see Varoujean and Williams 1995). Miller and Ralph (1995) describe the results from boat surveys in northern California, carried out since 1990. More recent results are appended. For example, attached at Section 4 is a preliminary report to the marbled murrelet study trust (dated 5/13/98) prepared by Ralph, et al. At the U.S. Dept. of Agriculture, Forest Service, Redwood Science Laboratory and the USFWS, entitled "Abundance Distribution and Productivity or Marbled Murrelets Along the Northern California Coast in 1997." (Ralph et al. 1998.)

Line transects for marbled murrelet density estimates are modifications of a standard survey technique in wide application in wildlife research (Miller and Ralph 1995). Modifications for marbled murrelet surveys include running parallel tracks at different distances from shore. Typically, in northern California, these surveys are carried out at 800 and 1400 m from shore, bracketing the area of peak marbled murrelet abundance. In other parts of the range, marbled murrelets are distributed at different distances from shore (Courtney et al 1995). The survey technique does not detect all marbled murrelets present, nor does it provide a direct or accurate estimate of population numbers. However it does provide an estimate of local density that can be used to estimate population trend.

Redwood Sciences Laboratory (RSL) has collected and compiled data from at-sea surveys of marbled murrelet for the years 1989 through 1997. The methodology is described in Ralph and Miller 1995. In summary, it includes a coastal survey with transects at 800 meters and at 1,400 meters from shore. The entire coast is surveyed and data are reported in two kilometer sections. Intensive survey at other distances from shore is used to derive a murrelet distribution and allows density measures at the 800 meter and 1,400 meter points to be used to calculate the total population density for the section. Tables and graphic representations of the results of these efforts are attached at Section 15.

The Ralph et al. 1998 report (attached at Section 4) demonstrates that in 1996, the mean murrelet densities detected during at sea surveys for most survey sections was quite low, in fact the lowest of all years during which such surveys were undertaken. However, as reflected in Figure 7 (graph of population trends prepared from the preliminary report of RSL data by Thomas Reid Associates, consultant to the Resources Agency), murrelet densities may have increased in 1997 for most sections of the Northern California coast surveyed. Table 1 (3 pages of at-sea survey data), presents the underlying mean number of marbled murrelets censused by coastal section, distance from shore, and year. Figure 8 depicts a map of the relevant coastal landmarks – i.e., rivers, points, capes and other features which delineate the at-sea survey segments.

2.c(ii) Demographic Models

Beissinger (1995) has developed a demographic model that may be used to predict population trends in marbled murrelets. Beissinger's model was structured using field data on the ratio of juvenile marbled murrelets to adult marbled murrelets, collected during at-sea surveys near the end of the breeding season when plumage characteristics between the two are still evident. Because of the many uncertainties about marbled murrelets and the lack of critical information on many parameters (such as survival rates), Beissinger was forced to extrapolate many of his parameters from other species, and to use indirect evidence of other parameters. Based on his models, in conjunction with field evidence, Beissinger (1995) argued that the population of marbled murrelets was declining at an annual rate of 4 to 6 % throughout the listed range of the species, but that the rate of decline could possibly be twice as large. Others cautioned that these results may reflect a relatively temporary decline in reproduction. (Ralph et al. 1995; see also, Figure 7 and Table 1.)

Beissinger's results are highly dependent on the parameter values assumed in his model. The model is particularly sensitive to changes in adult survivorship, and in fecundity. Unfortunately these two parameters are poorly understood. Estimates of fecundity are derived in part from studies of nest predation (Hamer and Nelson 1995) and partly from off-shore surveys of juvenile abundance and adult-juvenile ratios (Ralph and Long 1995). Neither measure is a direct estimate of the essential parameter: the number of juveniles fledged per adult female. Both methods of fecundity estimate are subject to error from misrepresentative sampling, from aggregation of finds or data, and other sources.

Akcakaya (see Section 5 attached: "Ecological Risk Analysis For the Marbled Murrelet: The Sensitivity of Viability to the Parameters of the Zone-4 Metapopulation Model") has presented an alternative modeling approach that sets out the probabilities of marbled murrelet persistence using population modeling and the techniques of Population Viability Analysis. Akcakaya's results confirm the sensitivity of the model to assumptions on the demographic parameters of the marbled murrelet population. The model demonstrates that the effect of demographic uncertainty is so large as to make quantitative estimates of the effect of logging difficult. The concepts of this effort were presented to the murrelet recovery team, the advisory panel and other scientists. Again, due to the uncertainty inherent in quantifying murrelet demographic paraemeters, it was recommended that this Plan not rely on mathematical estimates of population viability. Hence, no completed reliable population viablity analysis for this species is available, and none serves as the basis for this plan. An additional model (LIMBS) is under development, using an individual based approach, and makes similar conclusions to those of Beissinger (1995). A preliminary outline of the authors' goals and intended methods to be used in developing this model was reviewed by the HCP murrelet science team and by the advisory panel in November 1997 (see section 7), but at the time this plan is drafted, that model has not been advanced or published.

Recent estimates of population trends in British Columbia are consistent with a declining population there (H. Carter pers. comm.). In a separate study, L. Lougheed has stated that adult survival rates in that population are lower than those estimated by Beissinger, although fecundity rates are substantively higher (Lougheed pers. comm.). In that area, uncertainty over estimates suggests that the population trend is somewhere between stable and declining at 6% annually. Because of the limited geographic extent of the Canadian study area, these results need to be treated cautiously; nevertheless the best available information is that marbled murrelets may be declining at 4 to 6% annually in various parts of their range.

Direct evidence for population change is shown in the data of Miller and Ralph (see Section 4 attached, Figure 7 and Table 1; see also Section 15). These at-sea census surveys, in northern California, have been carried out longer than any other investigation of marbled murrelet abundance. They thus represent the most current and direct evidence of population trends available. Because of the length of this study, there may be adequate statistical power to detect significant declines (Becker et al 1997). The data for change in the northern California population

are reflected in preliminary form at Table 1 and presented in a simplified graph (prepared by a separate reviewer) at Figure 7.

2.d The Reasons for Population Distribution Shift or Decline

2.d(i) Changes to Habitat

Based on extrapolation and assumptions of prehistoric levels of distribution, approximately 85% of the old growth originally found in California, Oregon and Washington may have been altered or removed by logging (Ralph et al 1995; Perry 1995). If accurate, it is reasonable to assume that this has reduced the availability of nesting habitat for marbled murrelets and that this is a major contributing factor in the decline of the species. In the southern part of the range, the species may have few unoccupied suitable nesting locations, and the birds may be "packed" into available habitat such as existing parks (Ralph et al 1995).

The US Fish and Wildlife Service has stated that loss of nesting habitat is the principal factor affecting the species throughout the southern part of its range (Recovery Plan p.45). This loss occurred on both federal and other land ownerships. It is not expected that this loss will continue; much of the remaining habitat is now protected on reserves in federal and other lands. It is expected that the majority of marbled murrelets will continue to be protected on these landscapes, under the Northwest Forest Plan (sometimes hereafter referred to as FEMAT) and approved Habitat Conservation Plans.

Eventually, succession and growth will lead to the development of new marbled murrelet habitat, as forests on federal and other ownerships mature. However the current best estimate is that these new habitat areas will not first become "available" until approximately 2045 (Recovery Plan).

Because previous forest harvest may have resulted in the loss of breeding opportunities, it has been postulated that some marbled murrelets may no longer be attempting to breed. In this case we may expect the population to decline until it reaches the carrying capacity of the remaining habitat. At this point the population should stabilize. It is possible that southern Humboldt County populations of marbled murrelets could stabilize; however it is probable that several more years of surveys will be necessary to determine current population trends.

2.d(ii) Predation

Alcids typically choose nest areas that are relatively free from predation. Hamer and Nelson (1995) argue that predation on marbled murrelet nests is higher than that experienced by other alcids or other canopy-nesting forest birds. They ascribe this high predation rate to habitat fragmentation, due to timber harvest. While this is a defensible hypothesis, it also noted that the numbers of some forest predators (notably Corvids such as Steller's Jays and Ravens) have been increasing rapidly in recent years, largely due to provisioning of food by humans (Marzluff and Balda 1992; Marzluff et al 1994, 1996).

Forest fragmentation was not found to be a major determinant of predation on artificial marbled murrelet nests in Oregon and Washington (Marzluff et al 1998); however the proximity of nests to human activity was found to affect predation rates, resulting in higher levels of predation. Marzluff et al (1998) conclude that predation may be an important and increasing factor in murrelet biology; however there is little conclusive evidence that fragmentation is increasing this rate, or that forest edges are the primary influence on predation rates.

Adults are also subject to predation, at the nest and elsewhere. Predators include ravens, owls, and other raptors. However there is no evidence that the predation rate on adults is large enough to be causing population declines.

2.d(iii) Net-Mortality

Mortality of sea-birds in nearshore net fisheries can have serious impacts on seabird populations (Carter and Sealey 1984). Estimates of loss of marbled murrelets in the past suggest that this factor may have been a significant cause of mortality and decline. This is likely no longer the case in this region.

Nearshore gill and trammel net fisheries have been active in California throughout this century, and major increases in effort occurred in the 1970's and 1980's (Takekawa et al 1990; Carter et al 1995). Gill-netting is currently prohibited north of Point Reyes and in waters up to 60 fathoms in depth from Pigeon Point Lighthouse in San Mateo County to the mouth of Waddel Creek in Santa Cruz County, and in waters up to 30 fathoms south of that point. Hence the loss of adults to gill-nets need not be considered a major impact on the marbled murrelet population.

2.d(iv) Oil-Spills and Other Pollution

Marbled murrelets are uniquely susceptible to oil pollution in the nearshore environment, in that they are resident year-round in the area of maximum vulnerability. Fry (1995) and Carter and Kuletz (1995) summarized the available data on the loss of marbled murrelets to oil pollution. Oil spills destroy the ability of feathers to regulate a bird's body temperature; oil also affects most of a bird's physiological systems (Burger and Fry 1993). The Exxon Valdez spill directly killed thousands of marbled murrelets or unidentified murrelets. Indirect effects were undoubtedly also important. Other significant events included spills at San Francisco (1971; 1984) and Monterey (1986). In November 1997, a significant spill in Humboldt Bay killed a minimum of 11 marbled murrelets. The overall loss of marbled murrelets to oil is unsure; loss of breeding adults is more damaging than any other loss to the population (Beissinger 1995; Akcakaya 1997; Section 5). Historically, most oil spills in Humboldt Bay are quite small, on average between 5 and 25 gallons.

2.d(v) Changing Sea Conditions

Changes in noted population density or distribution off shore can also be related to distribution or shifts in prey base and other affects related to El Nino Southern Oscillations (ENSO) in the marine habitat. (See Section 6, pp. 15-18 attached: "El Nino Southern Oscillations (ENSO) And Their Impacts on Marine Populations" Brosnanand Becker, 1997.) While there are no published studies that directly relate changes in murrelet population density with ENSO events, some studies suggest that lower abundance at surveyed locations may be due to ENSO. For example, during the 1993 ENSO, the murrelet population in Clayoquot Sound, British Columbia shifted from in shore waters to shallow, sandy channel waters. In this case, there is indirect evidence from 1979 and 1980 fisheries data implicating competing pressures for food resources driving this shift in murrelet distribution. During this same time, Strong, et al. (1995) reported a distributional shift of marbled murrelets from in shore to off shore waters along the Oregon coast. Indirect evidence based on visual sightings of feeding and prey availabilities suggest that this distributional shift is in response to a shift in prey resources. (Section 6 [ENSO paper] at page 18.)

ENSO events have magnified seasonal and interannual shifts on sea bird prey availability. Diet shifts have been reported in marbled murrelets from Alaska to California (Burkett, 1995). Seasonal shifts in the marbled murrelet diet are described in a review of feeding habitat by Burkett (1995). ENSO events are usually correlated with change or reduction in prey, and therefore, the best available scientific information indicates that ENSO events can affect temperate sea bird distribution.

Marbled murrelets feed in near-shore marine waters, mainly within one to two kilometers (.6 to 1.2 miles) from shore. These near shore waters include estuaries, bays, island groups, and more open coastal waters. These waters and their associated prey resources (small fish and invertebrates) are influenced to a significant degree by their interface with adjacent mainland characteristics (e.g. river mouths and plumes, tidal currents, shore line and intertidal areas, coastal points and

topographical features, and human developments), as well as subsurface features (e.g. bottom sediments, banks, water depth, etc.). (See Recovery Plan page 29.)

Many prey species are concentrated in specific near shore waters where freshwater or estuary spawning areas, larval and juvenile fish rearing areas, near shore physical processes, and bottom substrates, sediments, and vegetation concentrate organisms from lower trophic levels to serve as food for marbled murrelet prey species. Throughout its range, the marbled murrelet consumes a very diverse group of prey resources, especially when one considers the few studies that have been done to date. This suggests great flexibility in prey choices and a high capability for using alternative prey, indicative of opportunistic foragers. (Recovery Plan, citing Carter, 1984 "At Sea Biology of the Marbled Murrelet in Barkley Sound, British Columbia," M.Sc. Thesis University of Manitoba, Winnipeg Manitoba.)

According to the Recovery Plan, such foraging flexibility may permit the wide distribution of marbled murrelets along coasts with suitable nesting habitat throughout their breeding range. This flexibility may also serves to reduce impacts due to interannual variability in prey resources due to several factors. Thus, intermittent El Nino or other warm water events would not be expected to cause very large marbled murrelet population fluctuations or great reductions in reproduction (especially over the long-term) even though marbled murrelets may undergo local shifts in the locations of foraging areas.

Given the variability and frequency and intensity of El Nino events, marbled murrelet reproduction could be lower than "normal" in some years, as has been demonstrated for many other sea birds. (See e.g., Section 6, Brosnan and Becker 1997; see also, Figure 7 and Table 1.) Like other sea birds, marbled murrelet populations have persisted through several frequent El Nino episodes over the last century and earlier. The murrelet may be able to partially compensate for these events by changing its foraging behavior and prey selection to some degree to use available resources. (Recovery Plan page 28.)

3. Distribution and Status of Marbled Murrelets in California

The distribution of marbled murrelets in California is highly disjunct, with a relatively large northern population which extends to southern Humboldt County. Mendocino County has few marbled murrelets, while an isolated population occurs in Santa Cruz and San Mateo Counties. There is no evidence of interchange between these population centers, although marbled murrelets are capable of making such large movements on a seasonal basis. The Recovery Team has recognized these populations, and designated them as Recovery Zones 4 (including murrelets in Southern Oregon), 5, and 6. (See Figure 9.)

Within the northernmost Zone in California (Zone 4), which extends from North Bend (Oregon) to the southern end of Humboldt County, murrelets are concentrated off Redwood National Park, and off the Company/ Humboldt Redwoods State Park area (see Figure 7 and Table 1).

4. Critical Habitat

Critical Habitat is defined in Section 3(5)(A) of the ESA as "(i) the specific areas within the geographic area occupied by the species, at the time it is listed . . . on which one found those physical or biological feastures (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon determination that such areas are essential for the conservation of the species." (16 USC 1532(5)(A).) At the time the marbled murrelet was listed, critical habitat was not designated due to it not being determinable at that time.

On May 24, 1996, the US Fish and Wildlife Service designated approximately 3.9 million acres of critical habitat for the Washington, Oregon, and California populations of marbled murrelet (61

Fed.Reg. 26256). Over 3 million acres, or 78%, of the designated critical habitat is on federal land, 21% is on state and local land, and 1% is on private land. (See Figure 10.) 33,000 of the 48,000 acres of the designated critical habitat in private ownership is owned by the Company. The designated critical habitat includes significant areas that do not now constitute current habitat for the marbled murrelet because of the age of the forest stands. Due to restrictions on timber harvesting imposed by the Northwest Forest Plan, much of the unsuitable critical habitat in federal ownership is anticipated to become suitable habitat over time. Table 2 (adapted from the Recovery Plan) shows the distribution of critical habitat by State, ownership and land allocation.

As shown in Table 2 nearly all of the designated critical habitat for the marbled murrelet (approximately 99%) occurs on public land, with approximately 78% of the murrelet critical habitat occurring on federal land alone. As a result, unlike the situation for most listed species (whose habitat is largely on private land), the future of the marbled murrelet is to a significant extent within the control of the federal land management agencies since the management of the federal lands, will play a prominent role in the recovery of the listed murrelet population in the three states.

Lands designated as critical were those areas identified as essential to the conservation of the species, with the major foundation of the designation being the Northwest Forest Plan. The U.S. Fish and Wildlife Service determined that the physical and biological habitat features (referred to as the "primary constituent elements") associated with the terrestrial environment that support nesting, roosting, and other normal behaviors are essential to the conservation of the marbled murrelet and require special management considerations.

Within the Critical Habitat Units (areas essential for successful nesting), the U.S. Fish and Wildlife Service focused on two primary constituent elements: (1) individual trees with potential nesting platforms, and (2) forested areas within 0.8 kilometer (0.5 mile) of individual trees with potential nesting platforms, and a canopy height of at least one-half the site-potential tree height. This includes all such forests, regardless of contiguity. These primary constituent elements were considered essential to provide and support suitable nesting habitat for successful reproduction of the marbled murrelet.

Potential nest trees include large trees, generally more than 81 centimeters (32 inches) diameter at breast height with the presence of potential platforms or deformities such as large or forked limbs, broken tops, dwarf mistletoe infections, witches' brooms, or other formations providing platforms of sufficient size to support adult marbled murrelets. Platforms should have cover for

protection from weather and predators, which may be provided by overhanging branches, limbs above the nest area, branches from neighboring trees, or surrounding forest areas.

On a landscape basis, the Recovery Plan found that forests with a canopy height of at least one-half the site-potential tree height in proximity to potential nest trees are likely to contribute to the conservation of the marbled murrelet. These forests may reduce the differences in microclimates associated with forested and unforested areas, reduce the potential for windthrow during storms, and provide a landscape that has a higher probability of occupancy by marbled murrelets. Nest trees may be scattered or clumped throughout the area.

No critical habitat was designated in the marine environment. Nonetheless, the recovery plan found that the species is inextricably tied to its marine habitat throughout the year. Aside from a few individuals that may occasionally feed in freshwater lakes, virtually all of the murrelet's diet consists of marine animals. Some adult mortality probably also occurs in the marine environment from natural and human activity sources. Given the essential role marine habitat plays in the marbled murrelet's life cycle, the Recovery Plan authors determined that recovery efforts will not be successful unless feeding, loafing, resting, and wintering marine habitats for the species and habitats for prey resources are secure.

Critical habitat serves to focus conservation activities by identifying areas that contain essential habitat features and that may require special management consideration. However, the Endangered Species Act does not provide any additional protection to lands designated as critical habitat. The proposal to list critical habitat for the marbled murrelet (59 Fed.Reg. 3811) clarifies the role of the critical habitat designation:

> "Designating critical habitat does not create a management plan for the areas, establish numerical population goals or prescribe specific management actions (aside or outside of critical habitat), or have a direct effect on areas not designated as critical habitat. Specific management recommendations for critical habitat are addressed in recovery plans, management plans, and in section 7 consultation."

This Habitat Conservation Plan, in conjunction with ESA Section 7 consultation with the USFWS and CESA consultation with CDFG under California Fish and Game Code sections 2081 and 2090 prescribes a management and conservation strategy designed to further the recovery goals and conserve the constituent elements of critical habitat designated for this species.

5. Recovery Goals

The US Fish and Wildlife Service has published a Recovery Plan, which sets out overall goals for the recovery of the marbled murrelet (i.e., the removal of the murrelet from the list of endangered and threatened species), as well as specific recovery recommendations for different parts of the range. The overall objectives of the Recovery Plan are:

1. to stabilize and then increase population size.

2. to provide conditions that allow for a 'reasonable likelihood' of continued existence of viable populations.

3. to gather the necessary information to develop specific delisting criteria.

Steps toward these objectives are:

1. observe an increase in the productivity of the population, as reflected by total population size, the juvenile: adult ratio, and measures of nesting success.

2. minimize threats to survivorship.

3. identify and conduct research and monitoring.

4. encourage cooperative research.

5. coordinate monitoring and research.

The Recovery Plan states the following regarding recovery actions in Conservation Zone 4 (which includes Company lands) are:

> "Recovery actions should be focused on preventing the loss of occupied nesting habitat, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new suitable habitat. Much marbled murrelet nesting habitat is found in state and national parks that receive considerable recreational use. The need to maintain high quality marbled murrelet terrestrial nesting habitat should be considered in planning any modifications

> to state or national parks for recreational purposes. Both highway and campground construction, including picnic areas, parking lots, and visitors centers, could present threats to the marbled murrelet through loss of habitat, nest disturbance, and/or increasing potential predation from corvids associated with human activities such as Steller's Jays and crows. Implementing appropriate garbage/trash disposal may help decrease potential predator populations in high human use areas such as county, state and national parks."
>
> "This Zone has large blocks of suitable habitat critical to the three-state marble murrelet population recovery over the next 100 years. However, the amount of suitable habitat protected in parks is probably not sufficient by itself to guarantee long-term survival of marbled murrelets in this Zone. On the other hand, a considerable amount of habitat is preserved in parks such that survival may be more likely in this Zone than in several other Zones. Private lands at the southern end of this Zone are important for maintaining the current distribution of the species. There is already a considerable gap in distribution between this area and the central California population in Zone 6. Efforts should be implemented to, at a minimum, not expand the current distribution gap." (Recovery Plan p.128.)
>
> The Recovery Plan recognized the role of Habitat Conservation Plans (p. 120): "Adequately designed and implemented HCPs will be very important in the conservation of marbled murrelets on state and private lands and are likely to be the most effective and acceptable means of protecting most occupied sites on non-federal lands in the near future and potentially providing replacement habitat in the long term."

6. Status of Other Murrelet Conservation Activities

Significant measures to conserve the marbled murrelet have been implemented since the murrelet was listed as threatened under FESA in 1992, including the following:

1. The approval of the Northwest Forest Plan (which prohibited harvest of occupied murrelet habitat and significantly restricted harvest of potential habitat on federal lands);

2. The approval of habitat conservation plans on state and private lands that provide significant protection for remaining murrelet habitat on state lands in Oregon and Washington (Washington State Dept. of Natural Resources HCP, Elliott State Forest HCP).

The Recovery Plan acknowledges the vital role of the Northwest Forest Plan in the efforts to recover the marbled murrelet:

> "A substantial step in the recovery planning process for the marbled murrelet took place with the development of the Northwest Forest Plan (Forest Plan). [T]he Forest Plan constitutes the backbone of this recovery plan."

This conclusion is supported by analyses of the impact of the Forest Plan on the conservation of the marbled murrelet. The Forest Plan is projected to conserve 89 percent of current murrelet

nesting habitat within the various categories of reserves on federal lands in California, Oregon and Washington. This represents approximately 75 percent of present murrelet nesting habitat in the three States (Ralph et al. 1995). The Forest Plan calls for protection of nesting habitat within half-mile circles around all occupied sites. Over the short term little further loss of current habitat on Federal land is anticipated. Over the long term, the amount of habitat on Federal land is expected to increase, as younger forests within the federal reserves mature. (Id.)

7. Scientific Basis of the HCP

The Habitat Conservation Plan was developed using general principles of conservation biology, and specific recommendations for the conservation of the marbled murrelet. The overall approach was to:

1. use the best available scientific information;

2. commission new scientific studies where necessary;

3. develop a consensus among scientists on the available data;

4. obtain outside review and oversight on scientific analyses;

5. use appropriate caution in the management of a threatened or endangered species; and

6. as far as practicable, to minimize the impact of this HCP on marbled murrelets.

The scientific information available to the HCP team is summarized above; additional documents are appended. Early in the drafting of the HCP, it become clear that additional information would be helpful in drafting a conservation plan. In consultation with US Fish and Wildlife Service and California Department of Fish and Game staff, a cooperative science program was designed, in order to provide up-to-date scientific information. Two areas of particular interest were identified: an explicit analysis of the risk faced by the population under different management scenarios; and, a better analysis of the use of Company lands by marbled murrelets.

7.a Conservation Biology Principles

Conservation biology is a relatively new science. Its principles were formulated in influential books by Soule and Wilcox (1980) and Soule (1986), but continue to evolve rapidly. It builds on the more established disciplines of applied ecology and genetics, and uses many concepts derived from these fields. Conservation planning is becoming an important tool for managers, as noted by Noss et al (1997) and others. Some of the more important principles can be stated:

1. Species survival may depend on persistence on a landscape, as a metapopulation: conservation strategies must retain enough habitat to maintain a minimum viable population.

2. In general, conservation planners should err on the side of caution.

3. Planners should plan for unexpected contingencies.

4. Plans should be monitored for success.

Very often, conservation planning uses reserves where habitat is preserved, with little or no management (such as forest harvest). Reserve strategies are typically designed with the following guidelines:

1. Conservation areas should be managed to maintain a viable population of the managed species.

2. In general, larger unfragmented blocks of habitat provide better reserves than many smaller, fragmented blocks.

3. Reserves should be centered around population segments which are reproducing well ('sources') and should avoid preservation of unsuitable habitat traps ('sinks').

4. Where appropriate, reserves should be connected, so organisms can move between them.

5. Reserves should be buffered against outside influences, as necessary.

Principle 2 is sometimes called the 'precautionary principle' (e.g. Noss et al 1997). Essentially it holds that conservation biology must often determine whether a proposed action will have a detrimental effect. In other sciences, it is normal to avoid assuming that an effect will occur without demonstrable proof. However, in conservation planning, the actions are often irreversible (as in development or destruction of habitat); hence it is essential to use appropriate caution, and only to proceed with actions that can be shown to have little risk (Noss 1986; Peterman 1990; Taylor and Gerodette (1993).

All these principles were used in the development of this HCP. The plan as described here is cautious: in every case of uncertainty, the most conservative assumptions were utilized. The HCP calls for a large number of large, buffered reserves, where existing and developing habitat will provide for the maintenance of a viable marbled murrelet population, well connected to other populations elsewhere.

7.b Conservation Planning for the Marbled Murrelet Population on Company Lands

The HCP was developed using existing and commissioned studies to guide conservation planning. The overall philosophy was to follow the recommendations of the Recovery Team, and to minimize loss of habitat in the planning area. The HCP also follows the general principles of conservation biology, as outlined above.

The following assumptions and planning principles were incorporated into the murrelet conservation strategy for this HCP.

1. The population is declining at a rate equivalent to 4-6% annually. Although (if this decline is due to the loss of habitat) we can expect that the population will eventually stabilize, we must plan to sustain a species currenlty in decline.

2. In cases of scientific uncertainty, a conservative approach is appropriate.

3. The HCP should plan for survival of the species on private lands until such time as public lands alone can support a viable population (estimated at 50 years).

4. A majority of existing marbled murrelets on Company lands may be protected by preserving a majority of habitat against harvest, in Marbled Murrelet Conservation Areas (MMCAs).

5. These MMCA reserve areas should be buffered against outside effects of predators and environmental conditions to promote successful nesting.

6. The MMCA reserves should also allow for eventual development of new habitat.

7. MMCA reserves should be centered around the presumed highest quality habitat areas.

8. Unentered old growth was presumed to be higher quality habitat than partially harvested stands, or "residual" stands.

9. Most murrelets in Southern Humboldt County are believed to occur on Company lands (including the proposed Headwaters Reserve). Although there has been scientific dispute about the extent of murrelet use of Humboldt Redwoods State Park, this HCP employed as a very conservative premise that as little as 4,000 acres of the Humboldt Redwoods State Park constitutes habitat occupied by marbled murrelets.

8. Evaluation of the HCP

8.a Effects of Harvest on Marbled Murrelets

For the purpose of estimating potential levels of "take," loss of the potential or actual habitat of marbled murrelets is here presumed to constitute "take" under the Endangered Species Act, although this point is subject to legal and scientific debate in light of the U.S. Supreme Court decision in Babbitt v. Sweet Home Chapter of Communities. This assumption has been made for planning purposes and does not constitute an admission that the removal of habitat constitutes "take" in all circumstances (e.g., where the habitat is not occupied). It is possible that birds displaced from breeding stands could breed successfully elsewhere (Ralph et al 1995). However we have here assumed the precautionary principle that marbled murrelets will be "lost" following harvest of their nesting habitat, even if operations are conducted outside the breeding season or in areas not actually used for nesting.

Loss of habitat – in minor proportion to all available habitat – cannot be presumed to have major impacts on the viability of the marbled murrelet population as a whole. Akcakaya (1997) (see Section 5 has shown that the effect of even large harvest levels (much greater than those countenanced here), will be indistinguishable in their effects on marbled murrelet survival and persistence in the local region. Akcakaya's models are themselves conservative in that they consider only the local population (Marbled Murrelet Conservation Zone 4), which will show maximum sensitivity to habitat alteration. At larger scales (i.e., the listed range), effects of local forest management will be even less pronounced.

To place this in a more global contex in endangered species management, Mace and Lande (1991) have developed a formula for determining the degree of risk faced by a species. They categorize three levels of risk:

Critical: 50% chance of extinction in 5 years or 2 generations.

Endangered: 20% chance of extinction in 20 years or 10 generations.

Vulnerable: 10% chance of extinction in 100 years.

These categories have been adopted by the International Union for the Conservation of Nature, in order to evaluate risks to different species. The guidelines are in wide use throughout the world, wherever species viability is a concern.

Generation time of the marbled murrelet is less than 10 years (see Beissinger 1995). Based on the best available data, and using conservative values for habitat loss, etc., the local population (the population in southern Humboldt County) of the marbled murrelet does not seem to meet these criteria. At the larger, three-state level, the risk of extinction would not be increased by this project.

Maintenance of a viable population of marbled murrelets in Conservation Zone 4 is an important goal of the Recovery Plan. Eventual recovery of the entire species, to the point of delisting, may depend on a well-distributed population in northern California (Recovery Plan p.145). The HCP Handbook issued by the Fish and Wildlife Service and the National Marine Fisheries Service states that the Section 10 permit standards "do not require HCPs to recover listed species or contribute to recovery objectives outlined in the recovery plan." (HCP Handbook p. 3-20.) Nevertheless, this HCP goes beyond the Section 10 permit standards to implement the relevant goals of the Recovery Plan by protecting in perpetuity the most important murrelet habitat on private land in Conservation Zone 4 (the 7,500-acre Headwaters Reserve) and by also providing protection for over 8,500 acres of other occupied, suitable, or developing murrelet habitat in the Plan area.

As more particularly described in the discussion, supra, at 1.c, it is estimated that a large majority of marbled murrelets currently on Company lands will be preserved under this strategy. It is simply not practicable to entirely avoid the potential for impact to murrelets from harvest while still allowing some economic use of property which is zoned exclusively for timber management and other compatible uses. Actual take of murrelets will be minimized and mitigated where practicable.

8.b Marbled Murrelet Conservation Area Strategy

The primary conservation tool of the HCP for marbled murrelets is the retention of approximately 8,500 acres of actual or potential habitat in 8 Marbled Murrelet Conservation Areas (MMCAs). This analysis segregates MMCAs according to forest type distinctions into 12 subareas. These areas are of varying size, shape and habitat characteristics, and are merged where geographically adjacent, often generically mapped as 8 larger areas (see e.g., Figure 2, see also, Volume V, Maps 25 and 26). Section 12, attached, contains a locator map and map key and 10 separate large scale maps of the MMCA areas depicting forest type distribution as prepared by Geographic Information System (GIS) database analysis. This MMCA strategy is aimed at conserving the great majority of habitat on the Company lands. This follows the recommendations of the Recovery Team that most habitat in the area should be conserved until the population stabilizes. MMCA strategies have been employed in other HCPs (e.g. Elliott State Forest, OR), where similar objectives were set.

The MMCA Reserves include substantial internal buffers. The initial goal of these buffers was to promote successful nesting by reducing the potential impact of predators such as corvids, and also to buffer against the potential adverse impacts of weather. Although buffers may not be necessary to protect against predation (Marzluff et al 1998), they have been retained under the cautionary principle. Similarly, there was extensive discussion by the Science Advisory Panel and others, of the possibility that some of the smaller habitat stands (including some preserved here and some to be harvested) were acting as population 'sinks' or non-reproductive traps (see, e.g. Section 7, Minutes of Panel Meeting of Nov. 10, 1997). Again, the HCP adopts a conservative approach, and has assumed that the harvesting of any occupied habitat areas does not benefit the species. Subsequent studies may disprove this assumption.

The MMCAs are distributed so as to cover essentially all the large, unentered old growth redwood stands on Company lands. (See generally Section 12; Table 3 (2 pp) and Figures 11 and 12.) Harvesting under the MMCA strategy is restricted to the smaller, most-fragmented or already partially harvested old growth and residual areas outside the MMCA's. Many smaller old growth stands and residual stands are also protected in the MMCA strategy.

MMCAs are concentrated together in the central and northern parts of the Company lands (see Figure 1, Section 12 locator map). This strategy maximizes the probability that birds from the different stands can interact together. It also ensures that marbled murrelet reserves are well distributed through the existing local range (the Humboldt Redwoods State Park ensures coverage to the South: Figures 1, 3)). There is also some evidence that marbled murrelets preferentially nest closer to the ocean; the MMCA strategy will conserve stands closer to the ocean over smaller, distant stands. Since the majority of murrelets in the bioregion appear to fly to inland habitat from

the area of Humboldt Bay, the MMCAs are positioned in a manner which is likely to facilitate access to nesting habitat, and social interaction.

8.b(i) Alternative MMCA Conservation Configurations

Several alternative MMCA conservation configurations were considered, and ultimately rejected, in an attempt to devise and implement a practicable reconciliation of the twin goals guiding this part of the plan: 1) providing adequate habitat conservation to permit continued survival of the species; and 2) allowing economic levels of harvest.

As described above, the MMCA configurations selected conserve the best habitat-value across the landscape, including the vast majority of significant unentered old growth redwood stands, larger patches of high density remnant or residual trees, as well as buffers, connecting or fill areas, etc. These elements were arranged to provide contiguity and microclimate and other biological benefits, consistent with the recommendations of the Recovery Plan, while retaining adequate timber volume, access and management opportunities.

Alternatives considered generally involve tradeoffs -- rearrangement of lower quality habitat, additional buffers, outlying patches and adjacent timber stands to place these within expanded MMCAs in exchange for the ability to harvest an equivalent timber value on volume in the lower habitat-value MMCAs.

By way of example, the Lower North Fork of Elk River (LNF Elk) MMCA contains no uncut old growth redwood, and relatively little (36 acres) of high density residual timber. (See Section 12 Map 1.) Therefore, this MMCA has a relatively lower habitat value than other MMCAs on a strictly "timber type/acreage" basis of analysis. However, in consultation with FWS and CDFG, it was determined that the LNF Elk MMCA presented many additional habitat-value features not reflected in such a strictly limited evaluation.

To place the issue in context -- and innumerable contexts can be assembled -- similar acreages and forest type mixes exist outside, but adjacent to, the Below Road 7 and 9 MMCA (Section 12, Map 4), aggregated with smaller areas available for harvest near or adjacent to the Bell Lawrence-Booths Run (Id. Map 2), Shaw Gift (Id. Map 5), Road 3 (Id. Map 8), and Grizzley Creek (Id. Map 10) MMCAs. Consideration was given to eliminating the LNF Elk MMCA and, as an alternative, expanding each of the above-named MMCAs.

Perhaps most importantly, LNF Elk has been the location of clustered "occupied" murrelet detections, in numbers, and at densities greater than any of the areas described above slated for harvest. (See Figure 6.)

LNF Elk is also closer to, and presumably would provide additional habitat supplementation for, the murrelets using the Headwaters Reserve.

If, as some have postulated, murrelets utilize watercourses as flyways to access nesting habitat areas or to guide them in "prospecting" for nesting areas, LNF Elk provides a reserve at the head of a separate subdrainage from the Headwaters Reserve (S. Fk Elk; see e.g. Volume V, Map 25). The mature forest connectivity along streams provided in the aquatics conservation strategy under this plan may also be beneficial for murrelets as they fly between the ocean and nesting habitat.

Another alternative MMCA conservation strategy considered but rejected involved configuring the reserves such that the Owl Creek MMCA would not be available as a harvest option, but that substitute acreage, and equivalent timber value, would be removed from other MMCA's and harvested. As described above, Owl Creek MMCA is comprised of a matrix of highly fragmented forest type blocks, including 317 acres of uncut old growth redwood, and 239 acres of mostly low density residual redwood. (See Section 12, Map 9.) While murrelets have been detected in this

MMCA, including some occupied behaviors (Figure 6), the numbers of such detections are low compared to other MMCA's. There is no other MMCA very nearby to maintain connectivity to Owl Creek, and its value lies soley in retention of occupied habitat.

Imporantly from the context of economic analysis, any fair "trade-off" involving removal of Owl Creek MMCA from harvest availability (thus conserving both Owl Creek MMCA and Grizzley Creek MMCA) would involve elimination of large components of the MMCA conservation matrix from protection to provide roughly equivalent value to the company. For example, focusing only on those current MMCA components without significant old growth redwood, it would be necessary to make available for harvest all of LNF Elk MMCA (Section 12 Map 1), as well as all of Elkhead Residual MMCA (Section 12 Map 3), all of Cooper Mill MMCA (Section 12 Map 6), Below Road 7&9 MMCA (Id., Map 4) and Road 3 MMCA (Id., Map 8). Even with all of these MMCAs eliminated from conservation, and made available for harvest instead of Owl Creek MMCA, the company's harvest value -realization would be reduced by tens of millions of dollars, when compared to harvest of Owl Creek MMCA.

This alternative arrangement would also eliminate the significant conservation values of buffering and contiguity provided by the selected MMCA strategy in the components described above.

8.c Stand Level Evaluations for Each MMCA

In this section, each Marbled Murrelet Conservation Area (MMCA) is described. The contribution of each MMCA to the overall conservation strategy will also be described. The Headwaters Reserve is not described as an MMCA because under the HCP it will be sold to the federal and state governments and protected in perpetuity. However, the preservation of the Headwaters Reserve, transferred to governments for approximately one-half its fair market value, is the most important murrelet conservation measure in the HCP. The additional conservation benefits provided by the MMCAs and other conservation measures in the HCP (e.g. riparian buffers) are designed to complement the benefits provided through the establishment of the Headwaters Reserve and further minimize and mitigate the impacts to the murrelet that are estimated to occur from the Covered Activities.

The overall intent of this component of the HCP, developed with guidance from the Recovery Plan and in consultation with USFWS and CDFG, is set out above. Important criteria for MMCA design were:

- MMCAs should be located in areas where marbled murrelets are most likely to be protected.
- MMCAs should be centered around the presumed highest quality habitat (unentered old growth redwood).
- Other habitat types (especially residual stands) also are of some conservation value, both as currently suitable nesting habitat, and as buffer habitat which is likely to become suitable during the permit period.
- Where possible, MMCAs should be buffered by forest types that will protect against potentially adverse environmental influences (windthrow, weather, predators).
- Where possible, MMCAs should incorporate habitat that, even if not currently occupied by marbled murrelets, may become occupied in the near future.
- MMCAs should be located in close proximity to each other, to allow ‘connectivity’ between reserves.
- MMCAs should be concentrated in the north-central sections of Company’s lands, to ensure geographic coverage. (Humboldt Redwoods State Park is a large reserve at the south of the area).
- Other factors to consider include identification of areas for conservation based upon proximity to the ocean, density and stand size of residuals, presence of potential nesting platforms, topography, size and extent of adjoining second growth stands, etc.

The following qualitative descriptions set out the conservation advantages of each MMCA broken down into 12 areas of contiguous forest type (see GIS maps at Section 12 and, for an overview, Volume V map 26. These areas often appear as 8 larger MMCA's (Figure 2). For example, the Bell Lawrence and Booth's Run occupied stands are grouped together in one MMCA on the large color maps in Volume V; as are Right Side Road 9 /Shaw Gift MMCA; and the Allen Creek /Road 3 MMCA. The table below briefly summarizes the characteristics of each forest type area within the MMCA's and identifies the relevant Section 12 GIS map numbers for reference.

MMCA Section 12 Map #	Murrelets	Forest Type	Fragmentation	Edge-to-Center Ratio	Buffer	Connectivity
L.N.Fork Elk Map 1	Occupied	Residual, Young Growth	High	High	Young Growth	Low
Bell-Lawrence Map 2	Occupied (many detections)	Old growth redwood, Some Residual, Young Growth	Intermediate	Intermediate	Residual, Young Growth	Booths Run adjacent to south
Booth's Run Map 2	Occupied (many detections)	Old growth Douglas-fir; Residual Redwood	Intermediate	Intermediate	Mid seral, Young Growth	Bell Lawrence adjacent to north
Elk Head Residual Map 3	Occupied	Residual Redwood	Low	Intermediate	Young Growth	Headwaters to west; Cooper Mill to south-west
Road 7 Map 4	Occupied	Some Old growth; Residual Redwood	Low	Low	Young Growth	Road 9 to east
Road 9 Map 5	Present	Residual Redwood	Low	Intermediate	Young Growth	Road 7 to west; RtSide RD9 to east
Rt Side Rd 9 Map 5	Occupied	Old growth, Residual redwood	Low	Low	Young Growth	Road 9 to west; Shaw Gift to east
Shaw Gift Map 5	Occupied (many detections)	Old growth, some Residual Redwood Old growth Douglas-fir	Low	Low	Residual, Young Growth	Rt side Rd 9 to west
Cooper Mill Map 6	Occupied	Residual Redwood	Low	Low	Young Growth	Headwaters to north; Allen Creek to south
Allen Creek Map 7	Occupied (many detections)	Old growth and Residual Redwood	Intermediate	Intermediate	Residual Mid-seral	Cooper Mill to north; Road 3 to east
Road 3 Map 8	Occupied	Residual Redwood	Low	Low	Young Growth	Allen Creek to west
Owl Creek Map 9	Occupied	Old growth and Residual Redwood Old growth Douglas-fir	High	Very High	Pre-merchantable	Low
Grizzley Creek Map 10	Occupied (many detections)	Old growth and Residual Redwood	Low	Low	Residual, Young Growth	State Park enclosed

(1) Lower North Fork Elk River

This MMCA comprises approximately 450 acres of forest (no unentered old growth; approximately 36 acres of residuals at high density (15-30 trees per acre) and approximately 200 acres of low-density residuals (less than 15 trees per acre). (Table 3.) Marbled murrelets have been detected in and adjacent to the presumed nesting habitat. Occupied behaviors have been seen at 5 stations in the MMCA. (Figure 6; see also Section 12 maps, Map 1.) This MMCA is highly fragmented, and has a high edge-to-core ratio. (Figure 4.) There is also opportunity for growth of short-term buffers, and the MMCA is not distant from other reserves. The major contribution of the MMCA stems from its northerly location, proximity to the ocean, ensuring geographic dispersal of the reserves. (See, generally, Volume V, Map 26; Section 12, Map 1.)

(2) Bell Lawrence & Booth's Run

The Bell Lawrence MMCA comprises, with the adjacent Booths Run Area, approximately 1,418 acres of forest (Table 3). Most of the old growth redwood is found in a single large unfragmented block on the edge of the Plan Area. Other old growth is found along riparian areas (Volume V, Map 26). Residual and young growth stands buffer these old growth areas. Many marbled murrelets have been detected on the MMCA, including many birds showing 'occupied behavior' (Figure 6). Marbled murrelet eggshells have been found on the forest floor in this MMCA. Post-breeding season tree climbing led to the discovery of one confirmed murrelet nest in the Bell-Lawrence stand, evidenced by a fecal ring left by the murrelet chick. The main old growth area is unfragmented, with a large 'core' area. The riparian areas are more fragmented, with higher amounts of 'edge'. Further buffering is provided by the Booths Run MMCA which is immediately adjacent to the south. There is one large block and two smaller stands of old growth Douglas-fir, and several stands (including one large stand) of residual redwood forest. Although stations to the south and east of the large old growth Douglas-fir stand do not show occupancy, there is some evidence of occupied behavior, which may be associated with either Douglas-fir or residual redwoods.

Apart from the single large block of Douglas-fir, this area is fragmented, with a high edge to core ratio. However there is some good potential for development of buffers and new habitat on the east edge of the area. There is strong connectivity to the adjacent Bell Lawrence stand. The major contribution of this MMCA is in providing connectivity to the north, and buffering of the Bell Lawrence stand, together with some potential for increase in the availability of suitable habitat. The major contribution of this MMCA is the large amount of high quality occupied habitat (Section 12, Map 2).

(3) Elk Head Residual

This MMCA is comprised of approximately 350 acres: 65 acres of low density residual redwood, with about 285 acres of young forest (Table 3). Few Marbled Murrelet detections have been noted in the area (Figure 6). The MMCA is immediately adjacent to the Headwaters reserve to the west. It provides buffering to the residuals and old growth of the Elk Head portion of that area. Eggshell fragments were found in the Elk Head Springs stand, leading to the finding of an active murrelet nest, as well as other inactive nests (Kerns and Miller 1995). The major contribution of this MMCA is to provide buffering to the Headwaters Reserve (Section 12, Map 3).

(4) Rd. 7 and 9 -- Shaw Complex

Together with the other stands of the Road7/Road9/Right Side Rd9/Shaw Gift complex, this stand comprises approximately 1,313 acres of forest (about 31 acres of old growth Douglas-fir, 353 acres of old growth redwood, and 406 acres of residual redwood) (Table 3).

Road 7 comprises a small area of old growth redwood, plus a larger area of residuals. Marbled murrelets are known to show 'occupied behavior' in the area (Figure 6). The stand is not highly fragmented, and has a low edge-to-core ratio (Figure 4). It has some potential for regrowth, but little buffering potential. It is immediately adjacent to the Road 9 Area. The main contribution of this Area is as part of a larger complex of connected stands, with substantial murrelet detections (Section 12, Map 4).

Road 9 comprises a core area of residuals. Marbled murrelets have been detected, but are not known to show 'occupied behavior' in the area (Figure 6). The stand shows some fragmentation, and has some potential for regrowth and buffering (Figure 4). It is immediately adjacent to the Road 7 and Rt. Side Road 9 stands. The major contribution of this area is in connectivity between the Road 7 and Rt. Side Rd. 9 stands (Section 12, Map 4).

Rt. Side Road 9 comprises a core area of old growth redwood, plus a surrounding area of residuals (Figure 4). Marbled murrelets are known to show 'occupied behavior' in the area (Figure 6). The stand is unfragmented, with buffering around the old growth. It is immediately adjacent to the Road 9 and Shaw Gift areas. The major contribution of this area is in conserving a buffered core of old growth redwood, with occupied murrelet status (Section 12, Map 5).

Shaw Gift comprises a large area of old growth redwood, plus some residuals, and old growth Douglas-fir. Many occupied detections of marbled murrelets have been recorded for the stand. Marbled murrelet eggshell fragments were found on the forest floor in the Shaw Gift stand, leading to the finding of an inactive murrelet nest evidenced by the fecal ring (Kerns and Miller 1995). The stand is essentially unfragmented, and has some potential for buffering and regrowth (notably of the residuals, and to the north of the old growth area). It is immediately adjacent to the Rt. Side Road 9 Area. The major contribution of this area is in preserving a large, well-buffered core of occupied habitat (Section 12, Map 5).

(5) Cooper Mill Creek

This MMCA comprises approximately 704 acres of forest, including about 151 acres of high density residual redwood, and about 245 acres of low density residuals. Marbled murrelets have been detected in the area, including some birds showing 'occupied behavior'. The stand is not fragmented, and has a low edge-to-core ratio. It is immediately adjacent to the Headwaters Reserve to the north. The major contribution of this MMCA is in conserving some marbled murrelet habitat in close proximity to the Headwaters Reserve. It has the potential to develop into a more heavily used area, considering its location and the higher density residuals (Section 12, Map 6).

(6) Allen Creek and Road 3

The Allen Creek stand, together with the Road 3 stand, and surrounding buffer, comprises approximately 2,293 acres of forest (about 393 acres of old growth redwood, about 40 acres of high density residuals, and approximately 930 acres of low density residuals). Many marbled murrelet detections have been noted in the stand, including many observations of 'occupied behavior'. Murrelet eggshell fragments have been found in the Allen Creek stand, but no active or inactive nests were confirmed. The core area of the stand is unfragmented, with a large area of old growth redwood. Adjacent to the core are areas of residual forest, and of mid-seral forest that provide buffering. The eastern section of the stand, adjacent to the Road 3 area, is more fragmented, and comprises residuals buffered by young forest. The Allen Creek stand lies immediately west of the Road 3 Area. The major contribution of this MMCA is to protect a presumed major concentration of marbled murrelet breeding habitat in the core area of old growth (Section 12, Map 7).

Marbled murrelets have been detected in the Road 3 stand showing 'occupied' behaviors. The MMCA comprises a large block of unfragmented residual forest. It is buffered by young forest, and is immediately adjacent to the fragmented portions of Allen Creek to the west. The major

contribution of this area is to provide recruitment habitat, as residual forest develops into older forest with more closed canopy (Section 12, Map 8).

(7) Grizzley Creek

At its option, PALCO may harvest either the Grizzley Creek or the Owl Creek MMCA (described below).

The Grizzley Creek MMCA comprises approximately 1,059 acres of forest, including about 118 acres of old growth redwood, and about 530 acres of residual redwood forest. Many observations of 'occupied' behaviors by marbled murrelets have been seen in the stands. The MMCA contains several discrete stands which surround the Grizzley Creek State Park, which itself comprises old growth redwood. The Grizzley Creek MMCA stand shows some fragmentation, but is well-buffered. The major contribution of this MMCA, if not selected for harvest, is to protect occupied habitat, and to buffer existing reserved habitat. A potential conservation benefit of the Grizzley Creek MMCA is its location in the Van Duzen River drainage, to the south of and several ridgelines removed from, the other MMCAs. This could lessen the danger of loss of murrelets and habitat in a separate watershed to catastrophic fire. The MMCA's location also places it as a potential "stepping stone" for murrelets moving from the Humboldt Bay area towards potential habitat to the south. A possible disadvantage of this MMCA is the location of a solid waste transfer station approximately 0.5 miles to the west of the MMCA along Highway 36. This facility has the potential to attract and nurture predators of the murrelet and its nests (e.g., corvids) (Section 12, Map 10).

(8) Owl Creek

The Owl Creek MMCA comprises approximately 925 acres of forest, including approximately 317 acres of uncut old-growth redwood, about 240 acres of mostly low density residual redwood, and about 19 acres of old growth or residual Douglas-fir forest. Marbled murrelets have been detected in the area, including some observations of 'occupied' behaviors. However, the numbers of such detections are low compared to other MMCAs. The old growth on the MMCA is fragmented, with large amounts of edge (Figure 6). However, there is good buffering from the adjacent residual redwood forest. There is no MMCA nearby to maintain connectivity. The major contribution of this MMCA, if it is not selected by PALCO for harvest, is to protect occupied habitat (Section 12, Map 9).

9. Mitigation

Outside of the MMCAs harvest will occur; therefore, some take is clearly anticipated. Nonetheless, the level of 'take' expected under this HCP is relatively low and is primarily limited to the areas with lower long-term murrelet conservation value. This "take" will be minimized and mitigated as follows:

a. Establishment of Reserves and MMCAs. In addition to the 7,500 Headwaters Reserve, created in connection with this Plan, large areas of existing or potential marbled murrelet habitat will be conserved for the length of this HCP. In total, over 17,000 acres of old growth, residual, and buffer conservation lands are protected, including some 8,500 acres in MMCAs. Additional old growth habitat will be protected within the limited entry buffers adjacent to riparian areas (see, e.g., Volume V, Map 7).

b. Enhancement of Existing Habitat. Existing lower quality habitat will be enhanced in the MMCAs, and the Headwaters Reserve during the life of the permit as second growth trees grow and shelter existing residual trees.

c. Limitations in Areas of Known Active Nests. In those areas outside MMCAs on company lands, harvest will occur, including operations conducted during the nesting season.

However whenever an active nest is discovered, activities will be restricted within _ mile of the site until such time as the nestling fledges, or the nest is determined to be abandoned.

d. Vegetative Buffers For Suitable Marbled Murrelet Nesting Habitat Within Public Preserves. Vegetative Buffers along suitable habitat edges will be implemented with the intent of minimizing the impacts of potential predators, and microclimate effects.

(i) Along the northern Humboldt Redwoods State Park ("HRSP")/Company boundary, from Highway 101 to approximately Snow Prairie, (See Volume V, Maps 25, 26) and for other adjacent HRSP lands, a 300' vegetative buffer from suitable marbled murrelet nesting habitat will be maintained. In the 300' buffer the late seral silvicultural prescription (Selection every 20 years, retention of 240 square foot Residual Basal Area) shall be utilized as a minimum for stand retention after harvest (see Figure 1).

(ii) For the Grizzly Creek State Park public lands along Highway 36 a 300' vegetative buffer from suitable marbled murrelet nesting habitat will be maintained. In the 300' buffer only the late seral silvicultural prescription (Selection every 20 years, retention of 240 square feet Residual Basal Area) shall be utilized as a minimum for stand retention after harvest (see Figure 2).

(iii) Suitable nesting habitat within the MMCAs has been buffered within the MMCA boundaries. No additional buffering is necessary.

e. Seasonal Restrictions in Buffer Zones. Seasonal Restrictions adjacent to suitable nesting habitat shall be implemented for specific operations with the intent of avoiding and minimizing "take" on public preserves (Grizzley Creek State Park, HRSP, Headwaters Reserve).

(i) A seasonal restriction on timber operations (such as falling, bucking, yarding, and log loading) shall be implemented within 0.25 mile, adjacent to suitable nesting habitat on public preserves (including the Headwaters Reserve). (See Volume 5, Map 1.) The seasonal restriction shall be implemented during the marbled murrelet breeding season (currently applied within California by the USFWS and CDFG as being from March 24 to September 15).

(ii) The seasonal restriction does not preclude use, maintenance and storm proofing of existing, previously used haul roads and other facilities.

(iii) Exceptions to the seasonal restriction limitations may be approved through consultation with USFWS and CDFG.

(iv) Seasonal restrictions are not required to protect breeding murrelets within the MMCAs for Covered Activities outside of the MMCAs because the MMCAs have been designed to incorporate appropriate internal buffers. "Take" is minimized through the implementation of the 300' internal vegetative buffers, and due to the infrequent management entries adjacent to the MMCAs. To the greatest extent feasible, activities with potential for disturbance of nesting marbled murrelets within the MMCAs shall be conducted outside of the marbled murrelet breeding season.

f. Limited Seasonal Restrictions on Timber Falling in Selected Habitat Stands: The Owl Creek or Grizzley Creek MMCA. PALCO has considered and agreed to limited seasonal restrictions on timber falling in either the Owl Creek or Grizzley Creek MMCAs, whichever is chosen to be harvested. These additional restrictions, in conjunction with the other

mitigations outlined above, and all the many mitigation and conservation measures detailed throughout this Plan, constitute the maximum practicable operational limitations PALCO can accept to minimize and mitigate the effects of the "take" of marbled murrelets anticipated and authorized under the Plan (see discussion of take minimization considerations below).

In PALCO's old growth timber stands, in the area commonly referred to as Owl Creek or Grizzley Creek, whichever is chosen for harvest, (see Figure 2), PALCO will refrain from conducting timber falling from May 1 to August 10. This is the period of time each year including the greatest level of murrelet nesting activity as correlated with the highest detected levels of murrelet occupancy behavior (Hamer and Nelson 1995, Beissinger 1995).

10. Management in the MMCAs

a. Management in the MMCAs shall be consistent with the goals and objectives of the MMCAs, and, except as expressly provided here, shall be conducted in consultation with the USFWS and CDFG. The goals and objectives of the MMCAs are as follows:

- Maintain the value of currently suitable marbled murrelet nesting habitat in the MMCAs.
- Recruit suitable marbled murrelet nesting habitat in old growth residual stands in the MMCAs.
- Provide buffering for, and contiguity of suitable and recruitment nesting habitat in younggrowth stands within the MMCAs.

b. MMCA Silviculture

In consultation and with the concurrence, or at the request of USFWS and CDFG, at PALCO's option, the silvicultural prescriptions described below may be employed to advance the goals and objectives of the MMCAs. PALCO shall not be required to undertake any such management in the MMCAs.

- Old growth stand components within MMCAs are to be dedicated to retention and enhancement of murrelet nesting habitat values. Except as provided below, no harvest or salvage activities shall be conducted.
- Residual stand components are to be managed to recruit functional murrelet nesting habitat. Thinning may be permitted with consultation and concurrence by FWS and CDFG to enhance recruitment of second-growth trees into the residual overstory. Any permitted harvest shall occur outside of murrelet nesting season and without any new roads. No helicopter yarding shall be conducted.
- Secondgrowth stand components within and outside of residuals are to be managed to buffer old growth and residual habitat and provide mature forest contiguity throughout MMCAs. Thinning or single tree selection permitted to accelerate recruitment of secondgrowth trees into a mature condition which buffers residual and old growth canopy structure. Any permitted harvest shall occur outside of murrelet nesting season and without any new roads. No helicopter yarding.

c. MMCA Infrastructure and Land Use

Certain activities, roads and other facilities within the MMCAs on PALCO's lands will remain

available for use, consistent with the Implementation Agreement regarding this Plan and subject to the below conditions. These activities are deemed to be compatible with protection of the marbled murrelet and its habitat within the MMCAs:

- Existing, active, previously used haul roads, borrow pit sources and permitted rock quarries within MMCAs may be used, maintained, stormproofed or abandoned. Active roads within the MMCAs are mapped at Section 8 and Section 12 attached hereto.

- Properly licensed and permitted game hunting -- including firearm discharge -- may continue, during the appropriate seasons, from and after September 16 of each year until March 23, to avoid potential disturbance to nesting murrelets.

- Maintenance and use of existing roads and facilities can require the removal of trees. To the extent feasible, such activities with the potential for disturbance shall be conducted outside the marbled murrelet breeding season.

- Fuel removal will be allowed only in residual and second growth buffers and will require consultation and written concurrence from USFWS and CDFG.

- Fire suppression will be allowed as otherwise provided in a fire management plan for the MMCAs approved by USFWS, NMFS, and CDFG within one year of the effective date of this Plan.

- Harvesting or salvage necessary for road maintenance, fire suppression, road stormproofing or abandonment shall be kept to a minimum. Downed, wind thrown and hazard trees within the streamside protection zone must be retained as required by the terms of the Aquatics Species Conservation Plan (Volume IV Part D).

- Stream enhancement projects in the MMCAs may be undertaken with prior written concurrence of USFWS and CDFG.

- Borrow pits and rock material sources within the MMCAs may be opened, and the material used for roads, drainage, maintenance, and repair without consultation or concurrence with FWS and CDFG so long as no trees greater than 12" dbh are removed from said locations, and no single new borrow pit area greater than 2 acres is cleared, with a maximum limit of no more than 2 new sites in any MMCA, with a cumulative total area of 4 acres cleared, after the effective date of this permit, for the full life of the permit, in any one MMCA. Any borrow pit site tree removal or land clearance in exceedence of these limits from and after the effective date of this permit will require consultation with and concurrency by USFWS and CDFG.

- Scientific surveys and studies as part of the Plan monitoring program described infra may be undertaken.

- Within the Allen Creek MMCA, as configured in consultation with USFWS and CDFG, is located one of PALCO's permitted hard rock quarries: Quarry 1, Road 24. The specific location, environmental setting, permit provisions, mitigations, certified environmental documentation and approved reclamation plan for this permitted and active quarry are included in the Plan at Volume II, Part J. Briefly, Quarry 1/Road 24 is located in the Yager Creek drainage, approximately 5 miles upstream from Carlotta, California. While quarrying operations typically involve excavation, drilling, blasting, screening, loading and related activities throughout the year, in recognition of the potential for disturbance effects upon murrelets in the Allen Creek MMCA, PALCO will limit all blasting to the period after September 15 and prior to March 24 of each year. To the maximum extent feasible, PALCO will also implement measures to mitigate disturbance impacts at other times of the year. These measures will include the recommendations by CDFG, for this quarry operation during the environmental review and permitting process. These measures are:

  - ◊ The loading of smaller aggregate into empty trucks prior to large rock, to lessen the impact of large rock; and

  - ◊ The noise generated by the back gate striking the body of the dump truck should be mitigated by one of several methods: (1) pulling away from the dump site slowly; (2) padding the area between the gate and the body; or (3) removing the back gate from the body of the truck.

11. Harvest of Remaining Timberlands Outside the MMCAs.

As proposed in this HCP, the MMCA configuration has been devised to conserve the majority of murrelet habitat on Company's timberlands throughout the life of the plan. The MMCAs include most of Company's current, high-quality, or potential future murrelet nesting habitat outside of the Headwaters Reserve and encompass the largest contiguous old growth redwood stands outside of the Headwaters Reserve. The MMCAs have been configured to provide contiguity and connectivity to the maximum extent practicable, as well as buffering to protect high quality habitat. In all, the MMCAs involve the conservation of 8,500 acres of redwood timber in addition to the approximately 7,500 acre Headwaters Reserve provided for under this Plan.

Pursuant to this HCP, timber harvest and management will occur in those areas not conserved in MMCAs, subject to the other restrictions specifically described in the Plan (e.g., riparian area restrictions in the aquatics strategy, see Volume IV Part D, Volume V Map 7). Such harvest will include the removal of habitat either currently occupied or potentially available for murrelet use. Timber management may constitute a “take” where it involves the removal or adverse modification of habitat which actually kills or injures identifiable individual threatened or endangered species. Such “take” would, however, be permitted pursuant to the incidental take provisions of the California and Federal Endangered Species Acts.

11.a <u>Considerations of Practicable Means to Minimize and Mitigate Take Outside MMCAs</u>

The Company has considered and evaluated theoretically possible measures to minimize and mitigate the impacts of potential take. These are discussed in the section immediately following. After this consideration, the applicant has elected to employ the mitigation provisions briefly summarized above.

Briefly, by way of summary, in consultation with the wildlife agencies, the Company has carefully considered seasonal restrictions and phased harvest schedules as options for minimization of take in areas slated for harvest outside the MMCAs. Evaluation of these options has resulted in the Company's conclusion that application of such measures to all harvest operations in all harvest stands is operationally infeasible, impracticable, and would render uneconomic timber

management within those zones slated for harvest ***outside*** the MMCAs and preserves, public land and streamside buffers, and other restricted areas. The following points summarize the applicant's consideration.

11.a(i) Background

The Company needs tens of millions of board feet per year of old growth redwood timber to meet its business needs, supply its customers and markets, and continue operation of its mills without substantial workforce reduction or other significant economic disruption to the Company, the local community and to Humboldt County, where it is the single largest landowner, private employer and taxpayer. In the past five years, on average the Company has harvested approximately 58 million board feet of old growth redwood per year. This harvest has occurred across the Company's ownership and over the entire calendar year.

Within the MMCAs, which will be reserved from essentially all commercial management activity under the HCP, is situated an inventory of approximately 270 million board feet of old growth redwood timber.

In areas outside the MMCAs, perhaps as much as 15% of the available old growth and residual timber volume will remain unavailable to harvest due to the extensive system of public land buffers and aquatic conservation restrictions detailed elsewhere in this Plan, as well as limitations due to the California Forest Practice Rules' even-aged harvest adjacency restrictions, sustained yield restrictions for the conservation of late seral habitat, and other limitations under thisPlan.

In addition, as described elsewhere in this plan, the Company has agreed to a system of wet weather road use restrictions which, in essence, constitute restrictions on operations over much of the winter and spring of each year. Very briefly, on a site-specific basis, pursuant to these agreed measures, log hauling and other heavy road use will cease after precipitation is sufficient to generate overland flow of turbid, sediment-entrained water off of the roads. Under this arrangement, roads will not be used for log hauling or other heavy equipment use until there has been a period of 48 hours with no precipitation or until the road surface is dry. These measures, intended to limit the potential for transport of sediment and silt into watercourses in amounts deleterious to water quality, fisheries or other beneficial uses of water, significantly restricts the time within which harvest operations may be undertaken.

Additional seasonal restrictions, during the spring, summer and fall months to coincide with the murrelet nesting season, would effectively preclude all harvest except within unpredictable periods of several weeks or less throughout the year, thus rendering commercial management impracticable. “Phased” harvest schedules, whereby harvest proceeds from lower density or lesser quality to high quality over time, would similarly constrain the Company, eliminating necessary flexibility and management discretion and render its harvest operations uneconomic and infeasible.

11.a(ii) Analysis

Traditionally, most of the Company's harvest operations -- approximately two-thirds of the annual volume of old growth and residual timber -- has been conducted during the summer months. In other words, seasonal restrictions considered in association with murrelet nesting place management off-limits during the traditional logging season -- the six month period of May through October.

In the absence of an HCP or incidental take permit, a seasonal restriction period has been applied in consultation with wildlife agencies to avoid direct take, and prevent harvest in potential or occupied murrelet habitat during the murrelet nesting season from March 24 through September 15. In the past, when operations have been restricted during this period due to murrelet concerns, harvest and log hauling has taken place during the winter period.

Now, with the wet weather road use restrictions provided in this plan, old growth volume obtainable from winter operations is effectively cut in half. Previously, about one-third of all old growth redwood harvesting had taken place during the winter period from November through April of each year. Already, with wet weather road restrictions expected to limit winter period operations by approximately one-half, the volume available during this period would be approximately nine million board feet of old growth redwood timber.

11.b Seasonal Restrictions

The imposition of full seasonal restrictions (throughout the spring/summer months March 24-Sept. 15) in areas outside of the MMCAs would have a significant economic impact on the Company's operations. Historically, two-thirds of the volume of old growth redwood harvest has occurred during the summer. If seasonal restrictions are imposed outside of the MMCAs, the effective operating period would then be restricted to approximately a one and one-half month period (September 15-October 30, the traditional onset of the winter/wet-weather period).

It would be impossible, impracticable, and infeasible within this narrow window of time to harvest not only the two thirds of the old growth volume generally harvested during the six month summer period (which includes the murrelet breeding season), but also an additional half of the remaining one third of the volume previously harvested during the winter period and now, due to wet weather road use restrictions, which must be harvested at other times.

In short, because the Company has agreed to the wet weather road restrictions, in those stands released for harvest outside of the MMCAs, buffers, preserves, and riparian zones, harvest must take place during the summer period in most stands released for harvest to avoid significant operational and work force impacts.

11.c Phased Harvest/Occupancy Avoidance

In order to provide the Company adequate flexibility to plan and marshal available equipment, manpower, and administrative resources, the Company cannot commit to broad or all-inclusive "phased harvest" schedules -- i.e. proceeding to conduct harvest in order, from lower quality to higher quality trees or habitat blocks. Nor can the Company commit to manage known occupied habitat outside the breeding season while only areas or stands surveyed without occupied detections are harvested during the breeding season. Each of these alternative sub-options was further considered and rejected for at least the following reasons.

The implementation of commercial timber harvests involves the close coordination and management of complex procedures, men and equipment. Particularly when harvest involves mature and decadent redwood, these procedures cannot economically be undertaken and completed in very short time windows or in very limited areas or for very restricted volumes. A projected example of constrained operations is instructive.

Over the course of several weeks, between the conclusion of the murrelet nesting season and the onset of wet weather, for example, perhaps one or more harvest plan areas could be roaded. At most, roads, landings and a few "layouts" (berms designed to catch felled big timber to prevent shatter of logs) could be constructed in a very limited area. Few, perhaps ***no logs at all***, might be actually harvested in the first year of constrained operations. Impending winter rains (and the agreed wet weather road restrictions) would render impracticable the placement of heavy equipment (yarding towers and booms, trucks, tractors, helicopters, etc.) within these constraints. The Forest Practice Rules prohibit construction of tractor layouts on hillslopes during winter seasons, for example. If placed on harvest sites and hillslopes, the road restrictions could foreseeably prohibit the removal of heavy equipment during most of the winter. Even if smaller areas, with limited, prioritized (phased) harvest volumes were successfully harvested, the actual cost of each such operation would be grossly increased by the negative economy of scale effect.

11.d Summary of Considerations

Briefly, the Company estimates that employing either blanket seasonal restrictions or phased entry/occupancy avoidance constraints, most timber harvest plans in areas within which the consulting wildlife agencies have heretofore recommended take avoidance seasonal restrictions (suitable/occupied habitat) would take ***several years*** to implement, would be subject to sudden and unpredictable interruption, and would thus be impossible to coordinate across the landscape. The needed harvest volume could not be assured. Furthermore, ***repeated entry*** into constrained volume, "phased" or prioritized areas (again to attempt harvest once interrupted or to harvest additional, phased timber stands) would tend to ***increase*** the potential for cumulative effects from road, landing, skid trail use, layout construction, equipment access and re-entry, etc.

11.e Practicable Take Minimization

Following consultation with USFWS and CDFG, and synthesis of the above-described considerations, PALCO has devised a feasible program for minimization of "take" anticipated or foreseeable from harvest in those areas outside the MMCA reserves slated for harvest under this Plan. This program incorporates the best available scientific and commercial information to avoid direct take of nesting murrelets, chicks and pre-fledged young to the maximum extent practicable, as follows:

1. PALCO has agreed to limited seasonal restrictions, on timber falling only, in the Owl Creek or Grizzley Creek MMCA, whichever is chosen for harvest.

   (a) Should PALCO elect to harvest it, in Owl Creek or as an alternate, Grizzley Creek, timber falling will be restricted during the period calculated to correlate with the peak of the murrelet reproductive period, from May 1 through August 10 of each year. In other words, during this period, in the Owl Creek or Grizzley Creek MMCA timber stands, no falling of trees will be undertaken. All tree falling will be scheduled either before or after this period to avoid, as much as practicable, direct take of nesting adults, nestlings, and active nests or eggs.

11.f Bases for Take Minimization

11.f(i) Habitat Value

Among the timber stands slated for harvest under this Plan, Owl Creek and Grizzley Creek have been noted to demonstrate relatively high levels of murrelet detections. The Owl Creek MMCA contains hundreds of acres of old growth redwood and low density residual redwood, and other timber types. Occupied murrelet detections have been noted there. The Grizzley Creek MMCA contains hundreds of acres of high density residuals, as well as some old growth redwood. Occupied behaviors have also been noted in the Grizzley Creek MMCA.

11.f(ii) Murrelet Reproductive Season Avoidance

In order to avoid the direct take of murrelet nests, chicks or eggs, to the maximum extent practicable, timber falling will take place, in the Owl Creek or Grizzley Creek MMCAs prior to or following the period from May 1 to August 10 each year. In California, patterns of seasonal variation of activity of marbled murrelets in forested stands have been noted, with consistency, to peak during June and July of most years, diminishing rapidly in early August. (See, generally, Ecology and Conservation of the Marbled Murrelet, Ralph et al. 1995, Chapter 11, p. 117 et seq.; see also, detection probability analyses by Dr. Gary White, Section 11) Therefore, the constraint described should effectively minimize direct take.

The Headwaters Reserve, and the marbled murrelet conservation strategy here described (including the MMCA conservation areas), combined with the measures described in this plan to avoid direct take in the MMCAs and the buffered areas, together provide significant mitigation and constitute the maximum practicable level of minimization and mitigation of take to which PALCO can feasibly commit. The highest quality marbled murrelet habitat, believed to contain the most marbled murrelets and nests, has now been preserved in perpetuity, or conserved in accordance with the HCP, and measures have been developed to avoid any take of murrelets nesting in the Headwaters Reserve and the MMCAs. Areas outside of this extensive system of preserves and conservation areas must and will be available for economic harvest activity in accord with the constraints described.

12. Monitoring

12.a Overview

The Company will monitor this HCP on its lands, on lands transferred under the proposed land exchange, and on other adjacent lands and waters. The goals will be as follows:

1. to determine whether the HCP conservation strategies are implemented as written;

2. to determine whether the conservation strategies are having the predicted impact and effect on marbled murrelets.

These two monitoring goals can be regarded as implementation (or compliance) monitoring, and effectiveness monitoring, respectively. These goals follow from the recommendations of the US Fish and Wildlife Service (Recovery Plan), and mirror similar efforts elsewhere in the region (e.g. Madsen et al 1997, for federal lands).

Implementation monitoring will document the types, amounts, and locations of forest management activities carried out within the HCP planning area. These monitoring activities may take the form of periodic reports on landscape-level conditions, using inventory and remote sensing information. For purposes of this routine compliance monitoring, in which landscape changes over time are recorded, the Northwest Forest Plan (FEMAT) provides for reports every 10 years. This Plan provides for a report every 5 years to USFWS and CDFG, documenting (through aerial photography GIS mapping, GPS reference points where available, and other methods available and appropriate) status, changes and trends in the MMCA areas. Items to be addressed in the report will include, but not be limited to, the following:

- Depiction of the MMCA boundaries and indications of the location and scope of nearby harvest operations.

- General description of any silvicultural activities undertaken with the advice and consent of USFWS and CDFG within the MMCAs, and a record of the consultation, correspondence, planning or other documentation associated with such activity.

- Depiction, description or other documentation, to the extent available, of any other consultation or correspondence between PALCO and USFWS/CDFG regarding any of the following:

    - ◊ use, expansion, abandonment or reclamation of the permitted Rock Quarry No. 2/Road 24 located within the Allen Creek MMCA;

    - ◊ use, expansion or tree removal to facilitate borrow pit material sources within the MMCAs, as provided in this Plan;

- ◊ road use, maintenance, stormproofing, drainage repair or maintenance, or related tree removal for same as provided in this Plan.

- ◊ Tree removal due to safety hazards.

Effectiveness monitoring will seek to document changes in the marbled murrelet populations on Company lands, and, to a lesser degree, on neighboring lands and waters, and changes in the habitat of these populations on Company lands, as more particularly described below.

Effectiveness monitoring will be carried out by Pacific Lumber personnel, and/or by outside contractors. The program will be overseen by the existing Scientific Review Panel, who will meet annually for the first five years of the plan to review monitoring program design, results, and to make recommendations for future studies. All data and results will also be reported to USFWS and CDFG.

Prior to the design and implementation of any monitoring plan, the Company will seek advice from statistical consultants on the most appropriate design of monitoring. This advice will include explicit treatment of statistical power, and the necessary effort to determine whether effects have occurred. These preliminary studies will then be used to guide the monitoring program, in consultation with the Scientific Review Panel, USFWS and CDFG.

12.b Conservation Objectives Guiding Monitoring Efforts

Effectiveness monitoring will be limited to terrestrial monitoring on PALCO lands, although, in keeping with the conservation objectives of this Plan, PALCO may also undertake to survey neighboring lands (subject to appropriate access and permission) and waters.

Specific objectives of the conservation program that will guide the effectiveness monitoring process include:

1. Maintain marbled murrelet nesting activity in the occupied stands within the MMCAs;

2. Maintain or recruit murrelet nesting activity in residual stands within MMCAs;

3. Recruit closed canopy high basal area second growth buffers for residual and old growth stands in the MMCAs;

4. Recruit second growth that provides shelter for nest platforms in residual stands in MMCAs; and

5. Minimize new development or activity which could disturb murrelet nesting in MMCAs.

12.c Research and Management Questions to be Addressed By Monitoring Efforts

Monitoring associated with the conservation objectives in this plan is intended to respond to the following research and management questions:

1. Are marbled murrelets continuing to use MMCA stands?
2. Are marbled murrelets nesting successfully in the MMCA stands?
3. What are the trends in local marbled murrelet populations?
4. What is the distribution of habitat in the bioregion?

12.d Methods for Monitoring

12.d(i) Use of MMCA Stands

Marbled murrelet surveys have previously been carried out in the MMCAs , in the Headwaters Reserve area, and in the Humboldt Redwoods State Park (see, e.g., Figures 5, 6). The Company will continue to monitor murrelets in the MMCAs, in order to determine the continued occupancy of these stands, and to gauge the levels of use of the stands. This will allow an assessment of the impact, if any, of management and conservation measures described in this Plan on the patterns of occupancy. At the same time, the Company will continue to monitor in the Headwaters Reserve, and in the State Park; areas within these stands will essentially serve as controls for any changes that occur in the MMCAs

Surveys will be carried out by staff or contractors, according to the existing Pacific Seabird Group protocol, and will determine the number and type of murrelet detections. The overall goal of the monitoring program is to determine whether the MMCAs continue to be 'occupied.' Essentially, the issue is whether the harvest of residual old growth and second-growth outside of the MMCAs is having any detrimental effect on habitat quality within the MMCAs, and if so, to determine the relative impact to the species from that effect.

MMCA areas will be monitored, with at least two survey locations in each. In addition, subject to permission and access, several control sites will be set up in the Headwaters Reserve, and in Humboldt Redwoods State Park. The surveys will be set up in such a way as to ensure that there is adequate statistical power to compare MMCA and reserve stands.

A subsidiary goal of the survey program will be to refine existing knowledge of the relative density of murrelets in different forest stands. It is anticipated that such refinement may allow the use of improved metrics of marbled murrelet habitat use. Additional research or survey methods (radar, telemetry, etc.) may be used if these are appropriate. At this point, inland surveys are not , by themselves, thought to monitor adequately marbled murrelet numbers effectively enough to allow estimates of population trends (Madsen et al 1997).

12.d(ii) Nesting Success

Marbled murrelet nesting success is hard to monitor directly. Under this HCP, PALCO will protect all known active nests, and will monitor their success. This will include nests found incidentally, and any others found using other techniques (radio-telemetry etc.).

Nesting success will also be monitored indirectly, using data from offshore surveys for productivity, and by censuses of nest predators, which will be carried out in conjunction with inland surveys.

Low estimates of productivity are currently normal for most populations of marbled murrelets (see Beissinger 1995 and references therein). In part this may reflect inaccuracies in the technique (comparison of adult-juvenile ratios) (Ralph et al. 1995). However the best available scientific information at this point is that productivity is indeed low, and reflects a population where many birds are either not breeding or may be breeding unsuccessfully. One interpretation of this observation is that the birds are limited by the availability of suitable nesting sites.

If these interpretations are correct, this HCP may not, in and of itself, result in higher breeding success. Few new nesting platforms not now extant can be reliably predicted to develop naturally within the early years of this plan. Eventually new nesting platforms will develop as a result of natural growth. Hence we do not expect the number of breeding sites to increase in the early years of this HCP. It is generally anticipated that the population will stabilize, and develop a normal age-structure; this demographic change will again take several years to develop. Essentially similar

reasoning has been put forward for the Pacific Northwest planning region as a whole, as considered by the Northwest Forest Plan Effectiveness Monitoring Team (Madsen et al 1997).

Under this HCP it is expected that there will be a small loss of existing habitat, and a slow growth of new habitat. Therefore it is expected that the population will continue to show low productivity in the immediate future, and that it will eventually show an increase in productivity. The exact timetable for this increase is hard to predict, but will exceed the generation time of the species (USFWS 1993; Madsen et al 1997).

If offshore monitoring shows a substantial decrease in productivity from existing levels, this may suggest that the population is declining more rapidly than predicted under this HCP. The Scientific Review Panel will help to determine the interpretation of the available information. However, no land management adjustments are required or anticipated under this Plan pursuant to results or analyses of offshore census data.

One potential explanation of low productivity is an increase in predator populations, or in attack rates of these predators. The latest information on marbled murrelet predators suggest that they are associated with human activity, but not necessarily promoted by forest management and fragmentation (Marzluff et al 1998). However the densities of these predators are increasing locally and state-wide. Corvid predator densities will be monitored at the same time as inland surveys. If corvid densities are seen to be increasing in MMCA areas alone, or in all areas of survey, this will indicate a likely cause of reduced nesting success.

12.d(iii) Marbled Murrelet Population Trends

Estimates of marbled murrelet population sizes and trends are most effectively monitored at sea. The Northwest Forest Plan (FEMAT) effectiveness monitoring team has recently discussed the best available methods for at-sea monitoring (Madsen et al 1997). The overall goal of that plan is to develop effectiveness monitoring for the Pacific Northwest. If murrelet populations are shown to continue to decline in the region, it is anticipated that the FEMAT implementation will be reevaluated. The Company has long been a contributor to a cooperative effort by government and industry to facilitate at-sea survey efforts in this area. That contribution to the now decade long monitoring program of the US Forest Service will continue under this HCP, and will supplement the proposed federal effort.

As described above, the best available scientific information suggests that the population of marbled murrelets offshore from the HCP area is currently declining at 4%-6% annually. This HCP has been developed under the assumption that this decline is real; the measures adopted herein assume that the regional population is not showing signs of stabilization. As discussed in the above section, it is to be expected that the population will show some decline, even after the loss of habitat has halted, because the species is long-lived.

Under this HCP there will be a small short term further loss of lower quality habitat, and an eventual development of new higher quality habitat. Given the demographics of such a long-lived bird, it is probable that the population will not begin to stabilize over the next five years. However it is also unlikely that the population will show elevated rates of decline under the moderate harvest schedule proposed.

It is anticipated that off-shore monitoring will be carried out by USFWS, CDFG, USDA Forest Service, and/or outside contractors. The Company will contribute to the existing cooperative research and monitoring effort under FEMAT and the Marbled Murrelet Study Trust. It is anticipated that this program will continue for at least the next five years. The Scientific Review Panel has indicated that this timeframe is necessary to detect any change in population trends (Section 7). The same timeframe is also indicated by power analyses of population surveys elsewhere in California (Becker et al 1997).

If, in the short term, population decline stabilizes, reverses, or continues at the present or lowered rates in the offshore population, this will indicate that the HCP has not adversely affected the population. If however the rate of decline increases, and such a decline is not matched elsewhere in northern California, the Scientific Review Panel will be consulted. Essentially similar approaches are being adopted by the federal government in implementing the FEMAT Northwest Forest Plan.

12.d(iv) Effectiveness Monitoring Annual Report and Consultation

Annually, beginning on the first anniversary of the effective date of the approval of this Plan and issuance of the associated Incidental Take Permits, PALCO will provide to USFWS and CDFG a report (Effectiveness Monitoring Report or Reports) detailing the following:

- The monitoring survey locations, results, data and analyses undertaken during the past year pursuant to this Plan;

- Depictions, descriptions or discussions of any purpose, planning or design documentation related to effectiveness monitoring anticipated for the coming year.

No sooner than 30 days after the provision of the Annual Effectiveness Monitoring Report, PALCO shall conduct a consultation meeting with USFWS and CDFG to discuss the Report and means, methods, techniques or adjustments in survey effort, data analyses or results interpretations. This consultation shall be advisory only with the goal of refining survey or analytical efforts to achieve the objectives and answer the research and management questions described above.

Following the consultation meeting with USFWS and CDFG, for at least the first 5 years of the effective term of this Plan, PALCO shall convene a meeting of the Scientific Advisory Panel to obtain the Panel's input and advice regarding effectiveness monitoring techniques, data management, analysis and interpretation, protocols or other related material and information. PALCO shall provide USFWS and CDFG at least 30 days advance notice of the date, time and place it will be convening the Panel, provide USFWS and CDFG access and opportunity to participate, and will prepare a summary and minutes of the proceedings.

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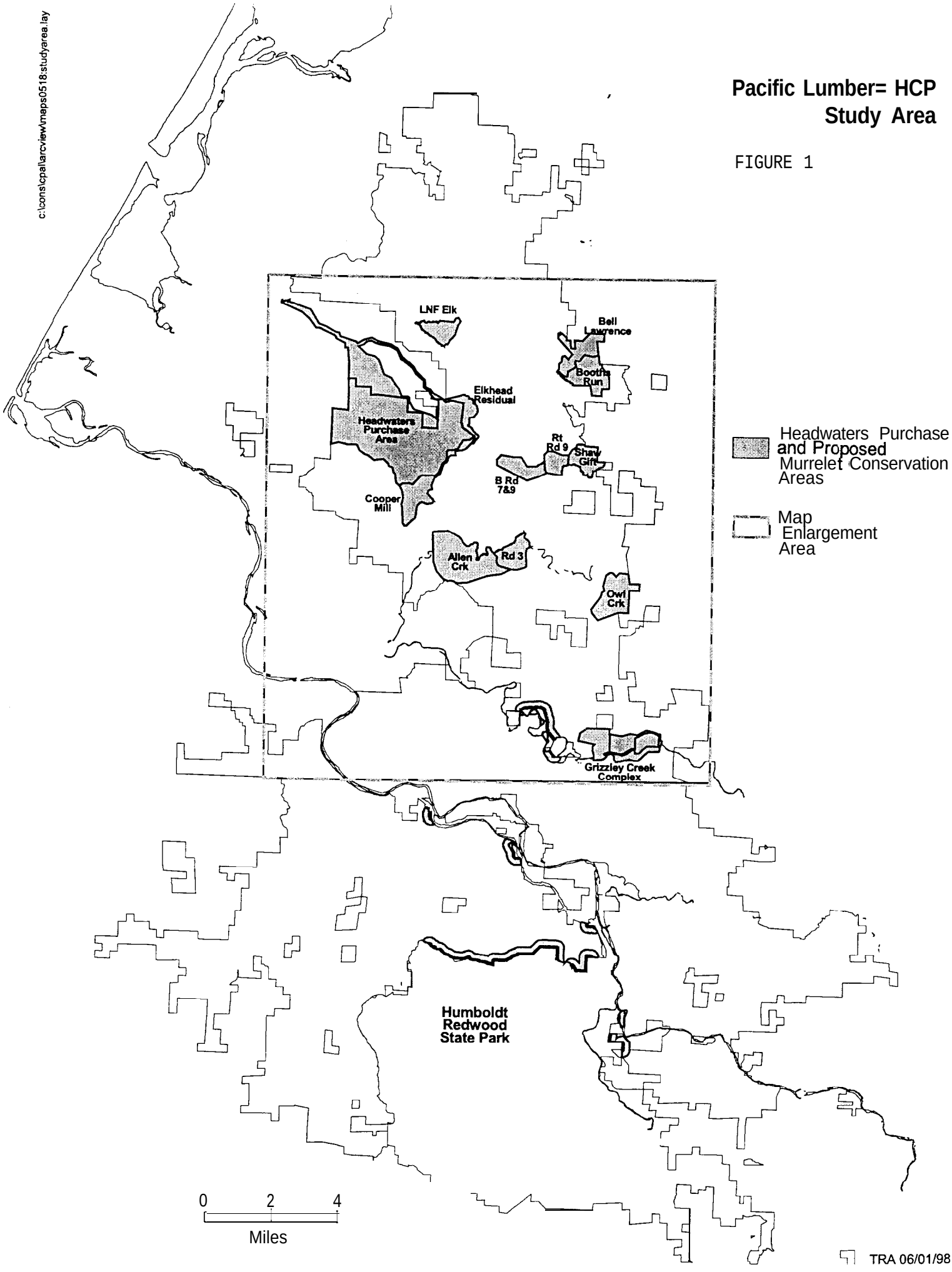
Pacific Lumber= HCP Study Area

FIGURE 1



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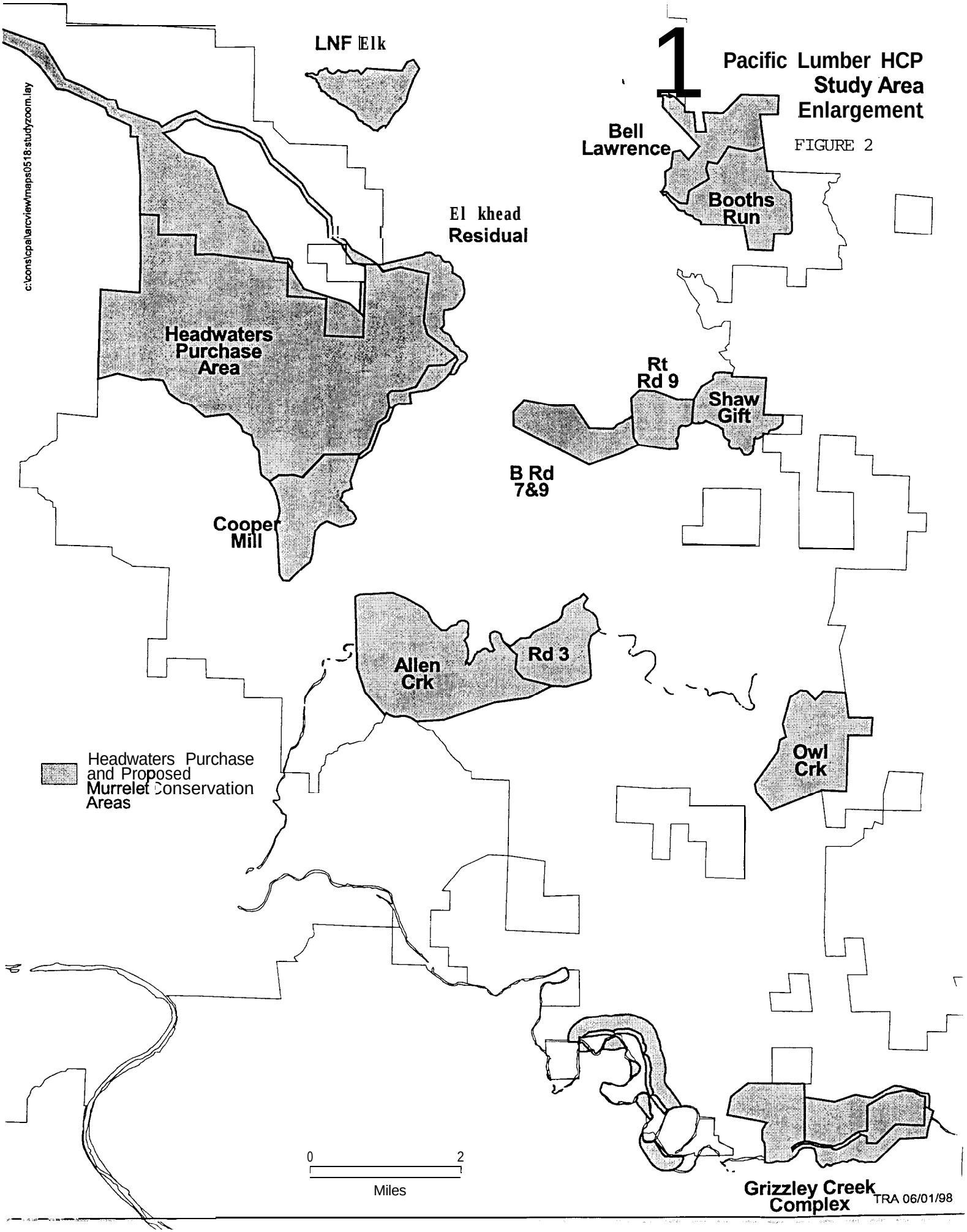
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LNF Elk
Elkhead
Residual
Headwaters
Purchase
Area
Cooper
Mill
Bell
Lawrence
Booths
Run
Rt
Rd 9
Shaw
Gift
B Rd
7&9
Allen
Crk
Rd 3
Owl
Crk
Grizzley Creek
Complex
Headwaters Purchase
and Proposed
Murrelet Conservation
Areas
0
2
Miles
1
Pacific Lumber HCP
Study Area
Enlargement
FIGURE 2
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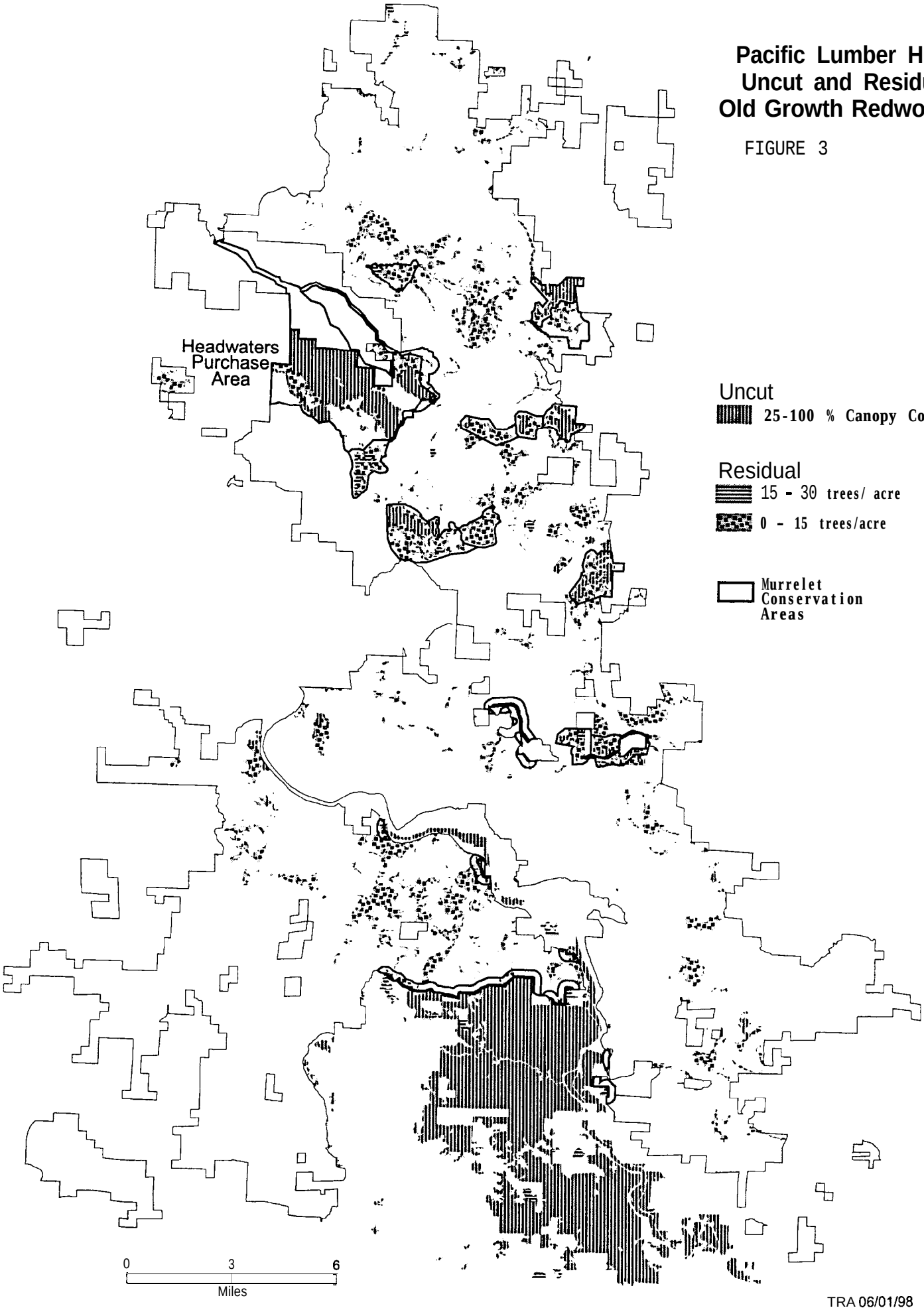
Pacific Lumber HCP Uncut and Residual Old Growth Redwood

FIGURE 3



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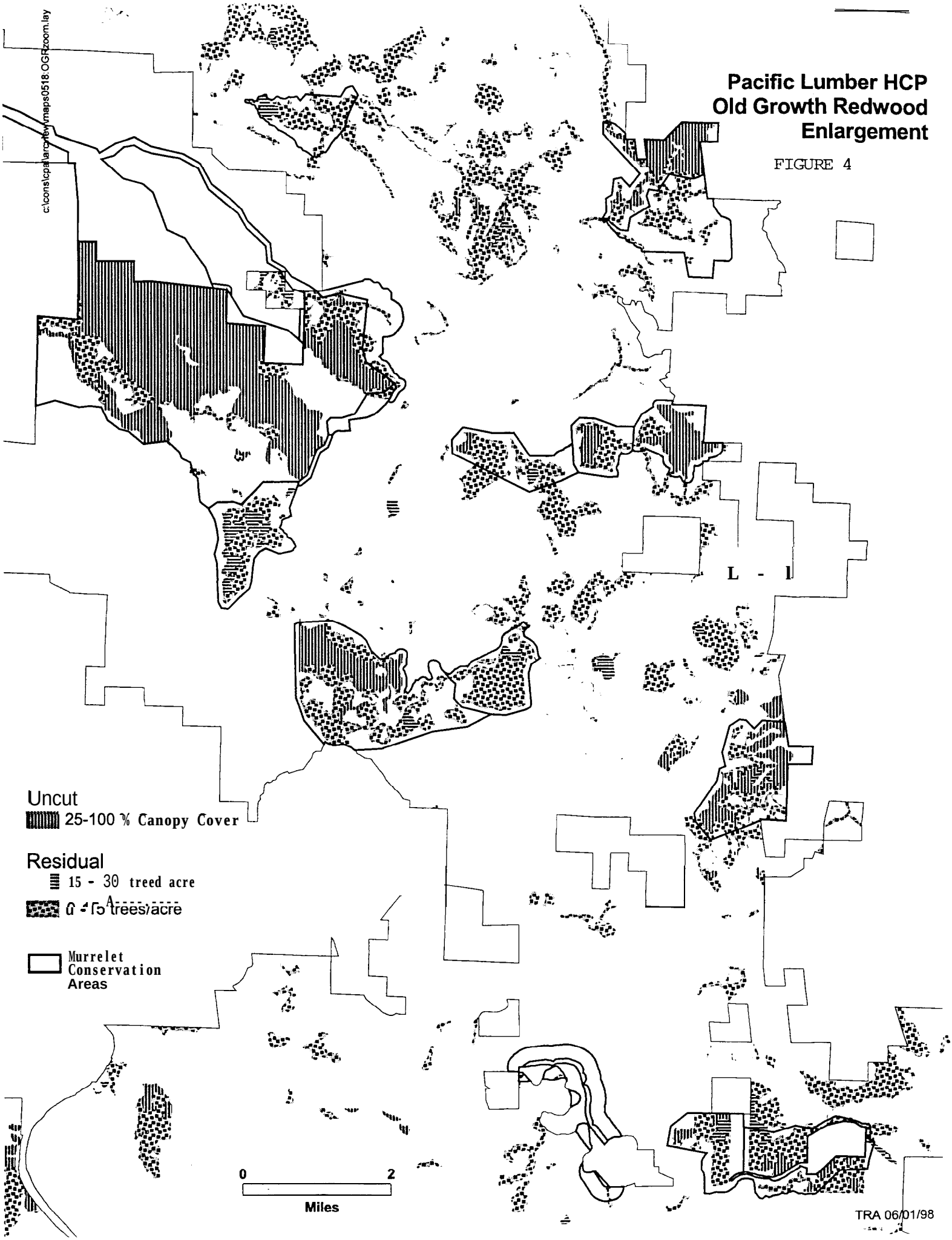
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Pacific Lumber HCP
Old Growth Redwood
Enlargement
FIGURE 4
L - 1
Uncut
25-100 % Canopy Cover
Residual
15 - 30 treed acre
0 - 15 trees/acre
Murrelet
Conservation
Areas
0
2
Miles
TRA 06/01/98

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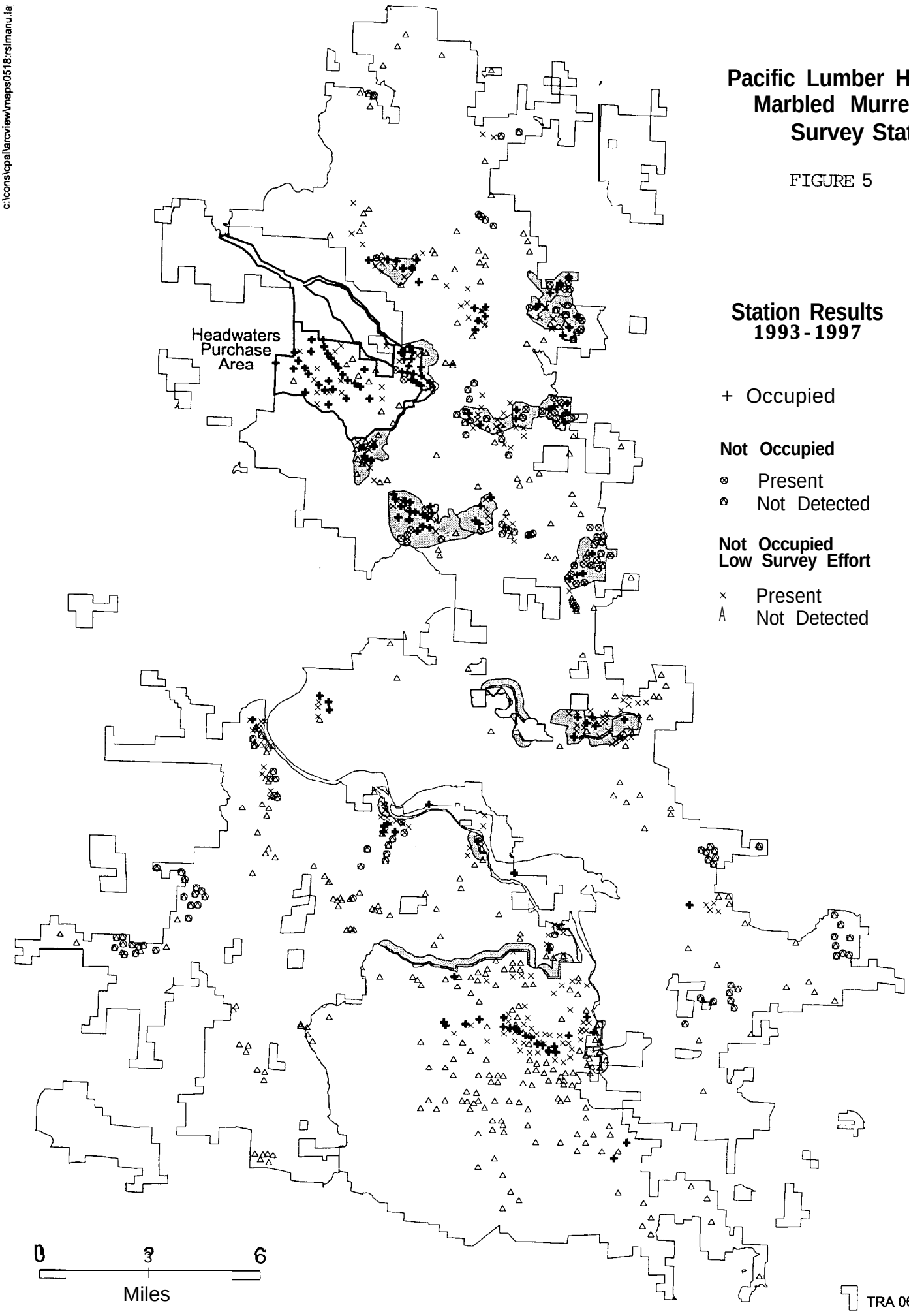
Pacific Lumber HCP Marbled Murrelet Survey Status

FIGURE 5



Station Results 1993-1997

+ Occupied

Not Occupied

⊗ Present

⊘ Not Detected

Not Occupied Low Survey Effort

× Present

A Not Detected

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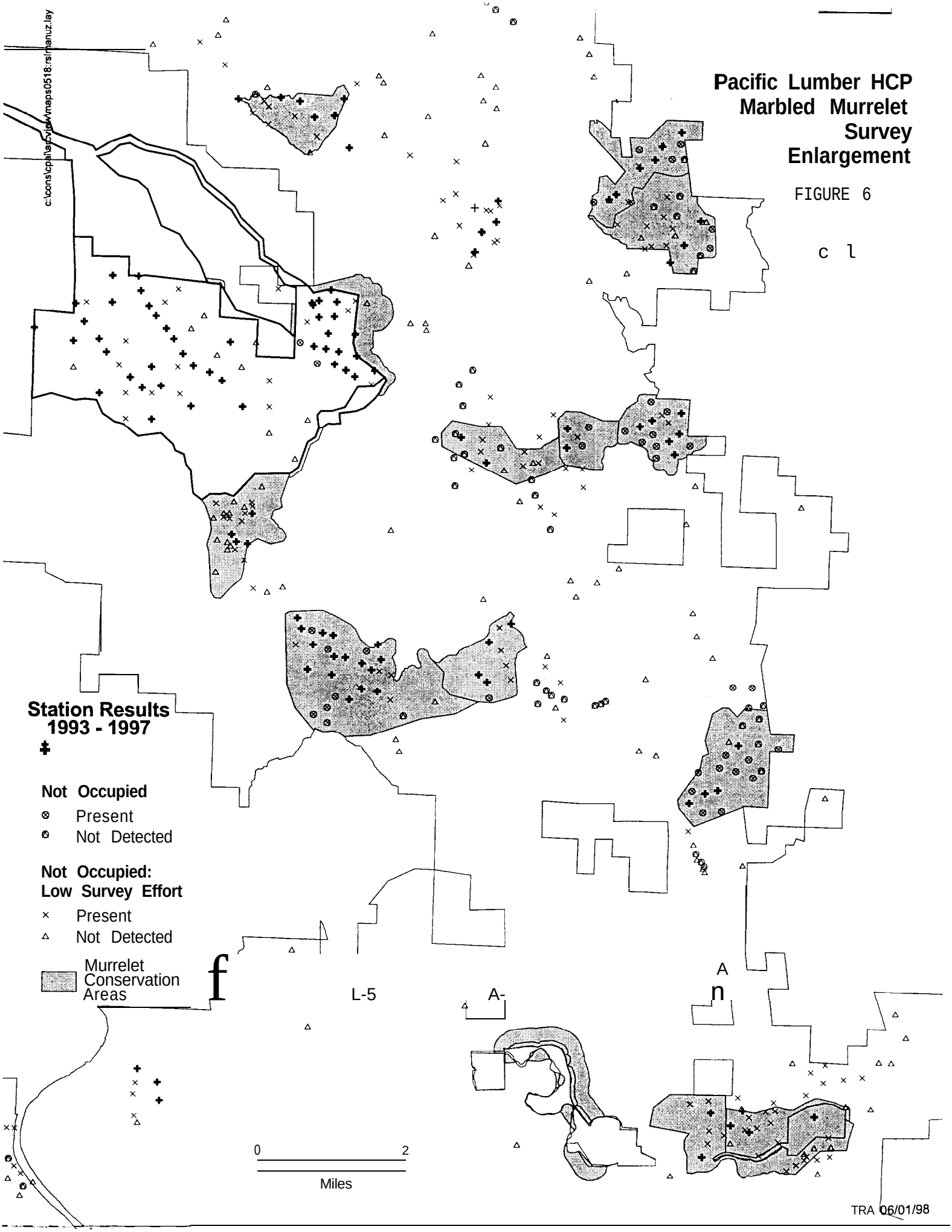
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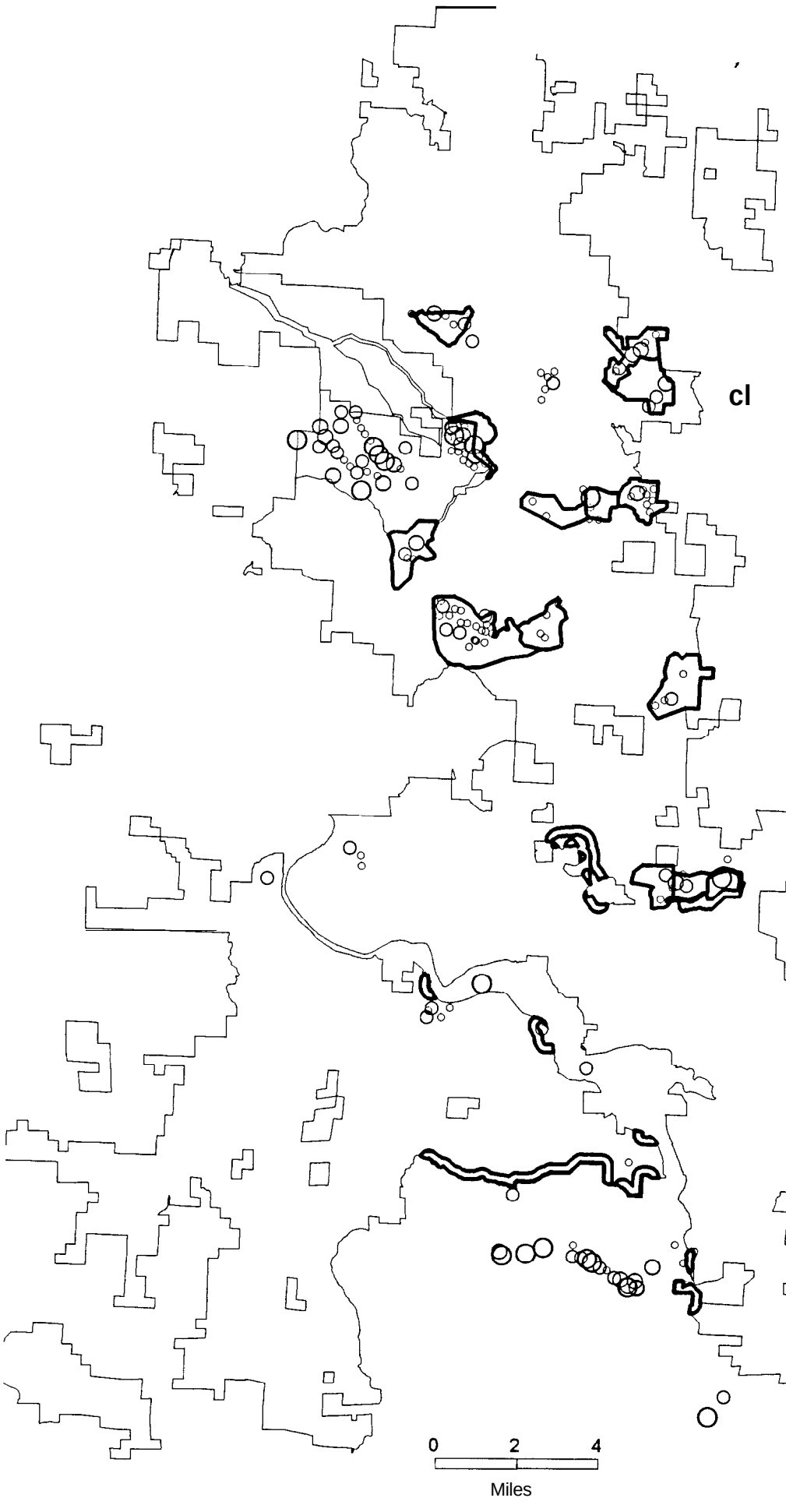
Pacific Lumber HCP
Marbled Murrelet
Survey
Enlargement
FIGURE 6
c l
Station Results
1993 - 1997
Not Occupied
Present
Not Detected
Not Occupied:
Low Survey Effort
Present
Not Detected
Murrelet
Conservation
Areas
f
L-5
A-
A
n
0
2
Miles
TRA 06/01/98

FIGURE 6a

Pacific Lumber HCP

Relative Frequency of Occupied Detection in Marbled Murrelet Surveys



Murrelet Conservation Areas and Public Land OGR Buffers

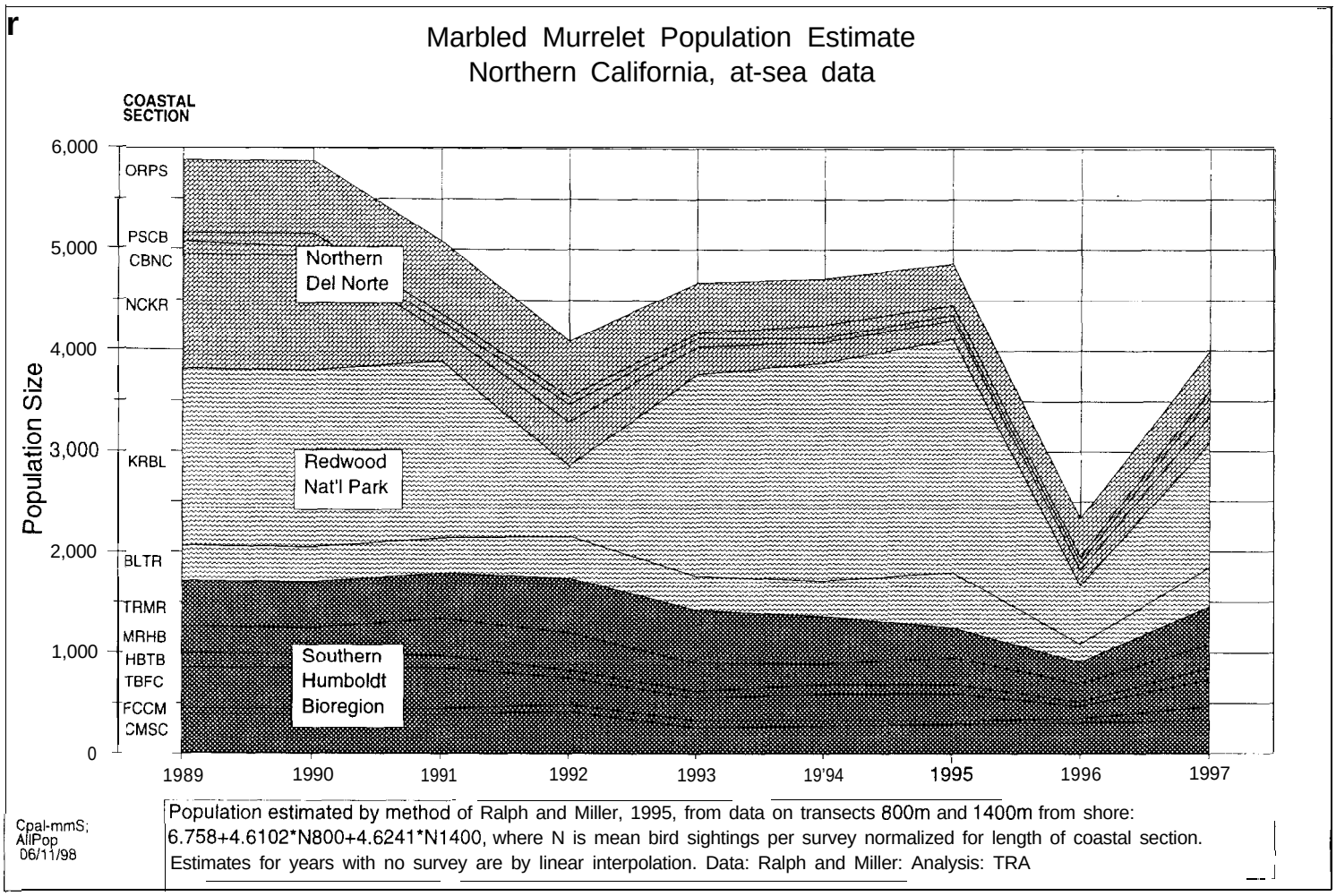
Detection Frequency

- Very High
  Highest 10% of stations
- High
  Top 25% to 10% of stations
- Medium
  Top 50% to 25% of stations
- Low
  Lowest 50% of stations

Source:
RSL Marbled Murreiet Data
1993 to 1997
Mean standardized occupancy per visit to station.
Analysis: TRA

TRA 06/14/98

FIGURE 7


Marbled Murrelet Population Estimate
Northern California, at-sea data
COASTAL SECTION
Population Size
6,000
5,000
4,000
3,000
2,000
1,000
0
ORPS
PSCB
CBNC
NCKR
KRBL
BLTR
TRMR
MRHB
HBTB
TBFC
FCCM
CMSC
Northern Del Norte
Redwood Nat'l Park
Southern Humboldt Bioregion
1989
1990
1991
1992
1993
19'94
1995
1996
1997
Cpal-mmS; AllPop 06/11/98
Population estimated by method of Ralph and Miller, 1995, from data on transects 800m and 1400m from shore:
6.758+4.6102*N800+4.6241*N1400, where N is mean bird sightings per survey normalized for length of coastal section.
Estimates for years with no survey are by linear interpolation. Data: Ralph and Miller: Analysis: TRA

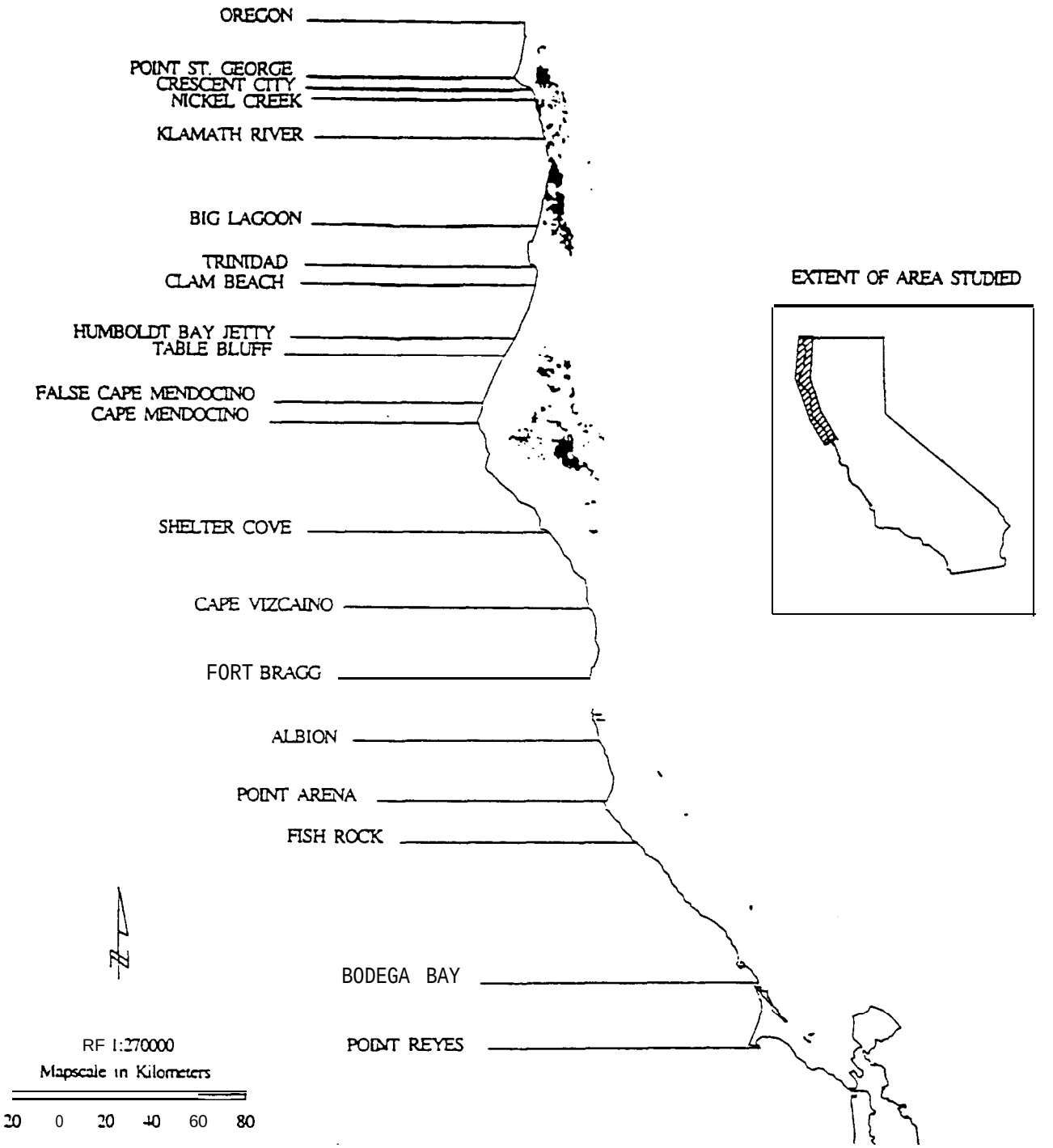


Figure 8 Study area offshore of the California coast.

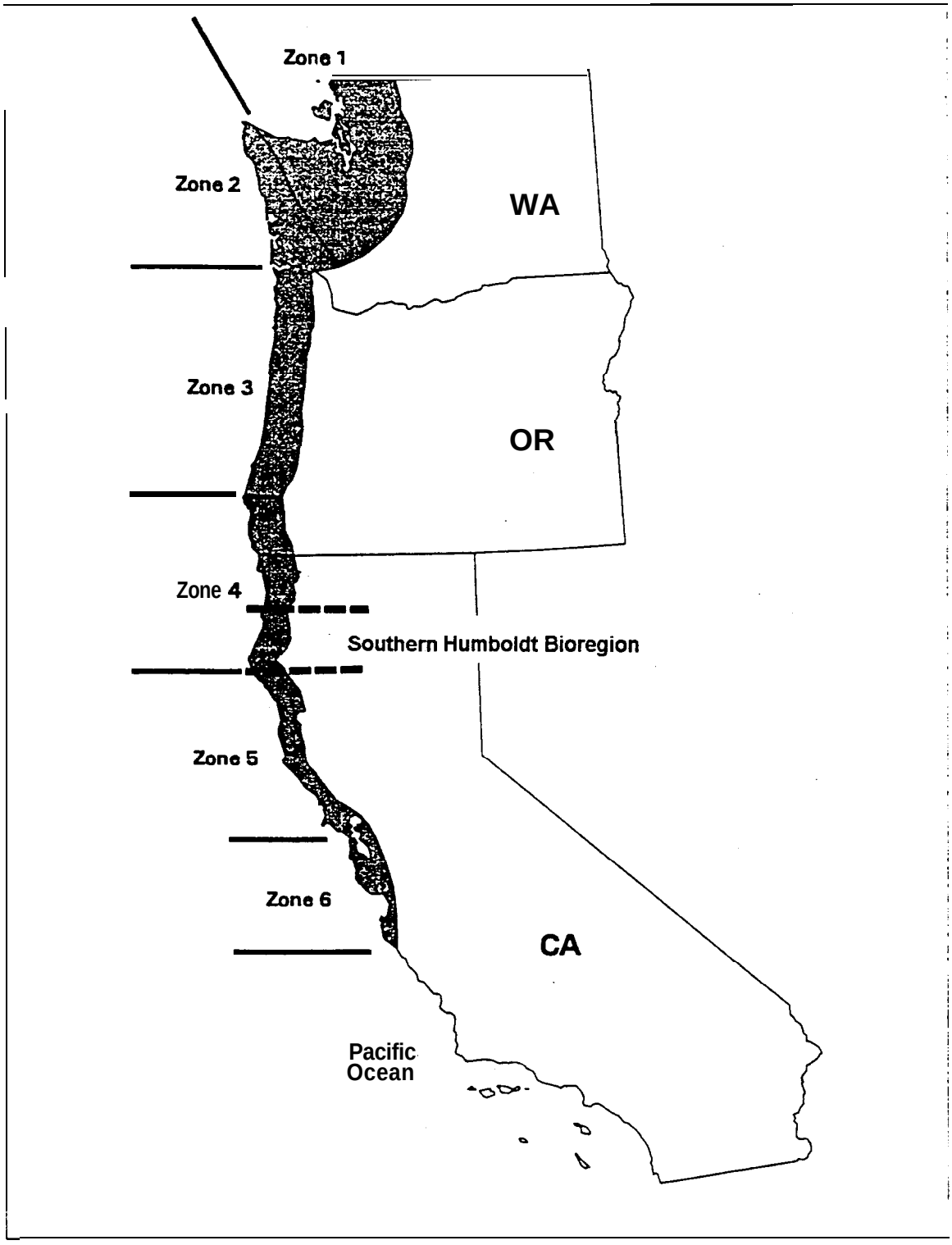


Figure 9 Map of the six Marbled Murrelet Conservation Zones (Zones). See text for descriptions.

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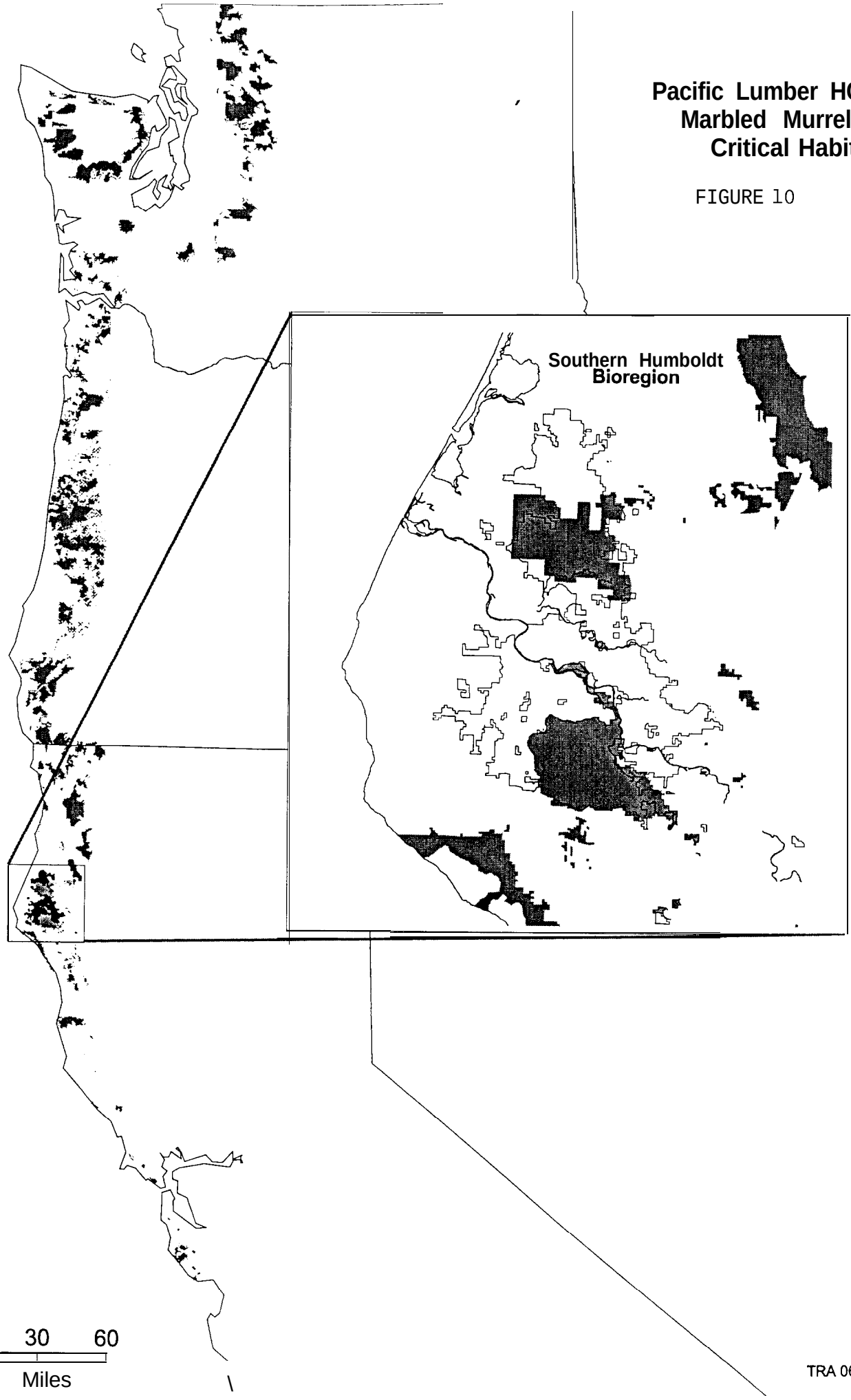
Pacific Lumber HCP
Marbled Murrelet
Critical Habitat

FIGURE 10



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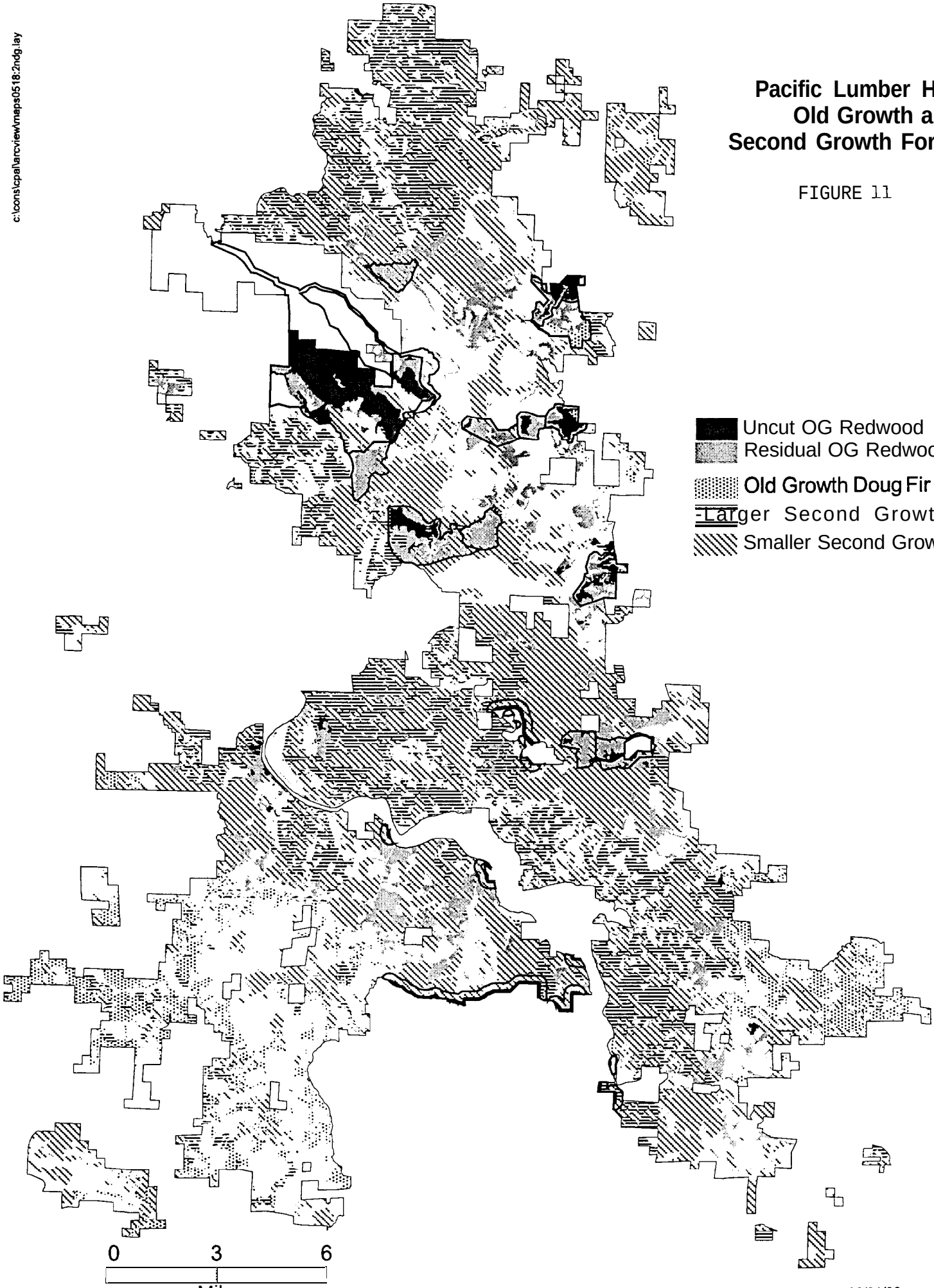
Pacific Lumber HCP
Old Growth and
Second Growth Forest

FIGURE 11



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Pacific Lumber HCP Old Growth and Second Growth Forest Enlargement

FIGURE 1.2

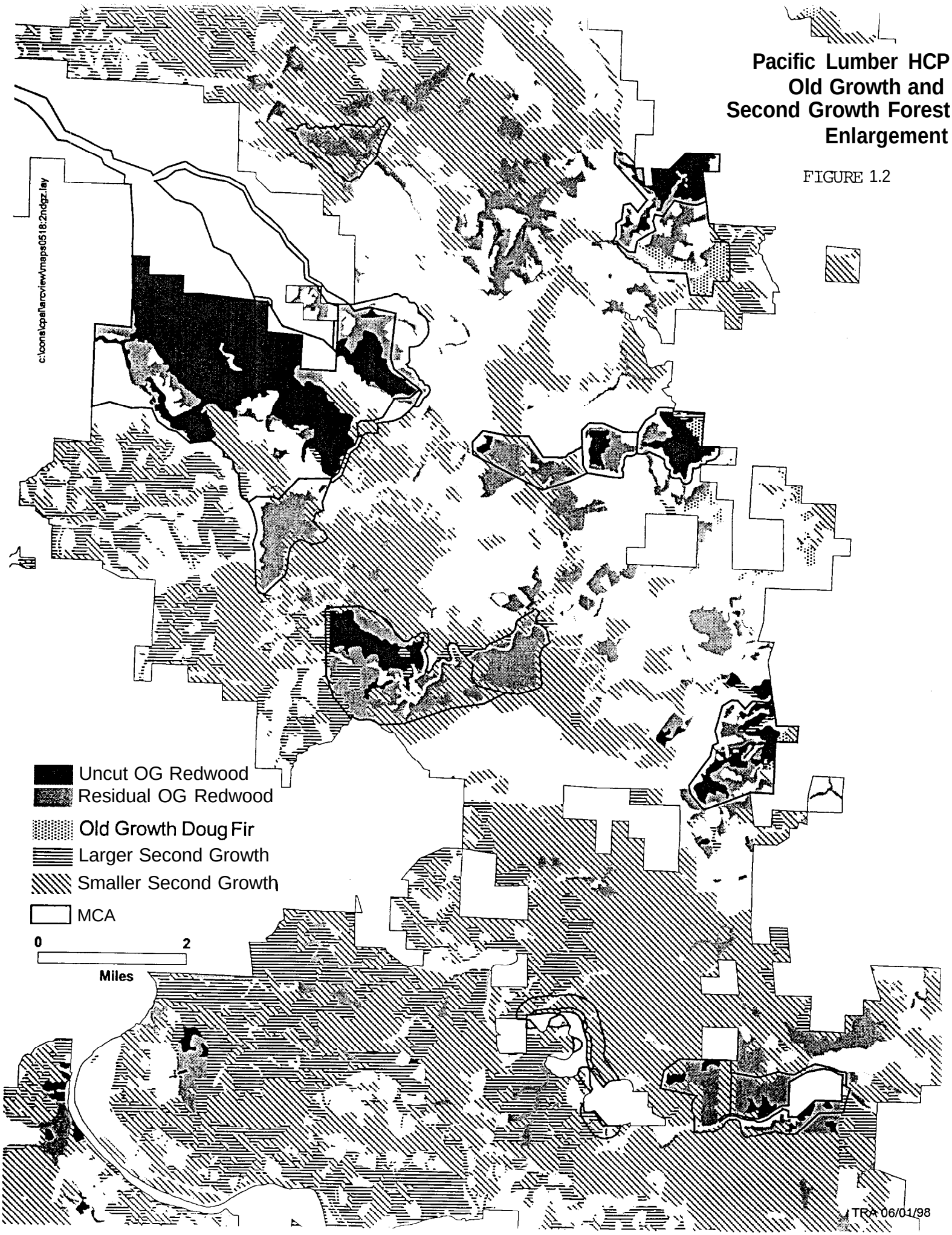

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Table 1. Mean number of Marbled Murrelets by coastal section, distance from shore, and year.

		800 m from shore						1400 m from shore					
Section'	Year	Total no. of segments	Number birds Total	Mean	S.E.	S.D.	Density (per km^2)	Total no. of segments	Number birds Total	Mean	S.E.	S.D.	Density (per km^2)
ORPS	1991	24	268	11.17	6.40	31.36	27.92	24	11	0.46	0.23	1.10	1.15
	1992	25	167	6.68	2.44	12.18	16.70	24	42	1.75	0.37	1.80	4.38
	1993	12	124	10.33	4.54	15.73	15.73	0	--	--	--	--	--
	1996	45	135	3.00	0.68	4.55	7.50	22	52	2.36	0.58	2.72	5.91
	1997	98	299	3.05	0.66	6.54	7.63	105	256	2.44	0.48	4.89	6.10
PSCB	1989	53	89	1.68	0.44	3.17	4.19	48	64	1.33	0.33	2.31	3.33
	1990	50	196	3.92	1.63	11.55	9.80	44	77	1.75	0.54	3.60	4.38
	1991	40	84	2.10	0.74	4.69	5.25	36	22	0.61	0.21	1.25	1.53
	1992	15	28	1.87	0.81	3.14	4.67	16	9	0.56	0.35	1.41	1.41
	1993	26	24	0.92	0.49	2.50	2.31	22	5	0.23	0.11	0.53	0.57
	1994	12	23	1.92	0.88	3.06	4.79	11	39	3.55	1.47	4.89	8.86
	1996	8	9	1.12	0.64	1.81	2.81	8	4	0.55	0.38	1.07	1.25
	1997	4	6	1.50	0.87	1.73	3.75	7	5	0.71	0.36	0.95	1.79
CBNC	1989	52	424	8.15	1.62	11.71	20.38	31	113	3.65	1.14	6.37	9.11
	1990	45	132	2.93	0.84	5.64	7.33	26	123	4.73	1.67	8.49	11.83
	1991	36	202	5.61	0.84	5.02	14.03	32	103	3.22	0.68	3.86	8.05
	1992	12	104	8.67	1.77	6.12	21.67	8	69	8.63	2.93	8.30	21.56
	1993	53	369	6.96	1.38	10.01	17.41	24	19	0.79	0.36	1.74	1.98
	1994	14	31	2.21	0.82	3.07	5.54	5	2	0.40	0.40	0.89	1.00
	1996	27	94	3.48	0.67	3.48	8.70	20	52	2.60	0.79	3.53	6.50
	1997	54	525	9.72	2.16	15.84	24.31	29	236	8.14	1.94	10.43	20.34
NCKR	1990	9	167	18.56	10.17	30.52	46.39	9	66	7.33	2.05	6.16	18.33
	1991	97	382	3.94	0.45	4.40	9.85	111	200	1.80	0.33	3.46	4.50
	1992	36	198	5.50	1.16	6.96	13.75	36	132	3.67	0.67	3.99	9.17
	1993	135	524	3.88	0.58	6.78	9.70	92	120	1.30	0.39	3.72	3.26
	1994	41	113	2.76	0.84	5.36	6.89	24	21	0.88	0.35	1.73	2.19
	1996	88	131	1.49	0.30	2.83	3.72	44	34	0.77	0.42	2.80	1.93
	1997	150	537	3.58	0.73	8.94	8.95	121	200	1.65	0.42	4.57	4.13
KRBL	1991	58	806	13.90	1.75	13.30	34.74	60	218	3.63	0.65	5.07	9.08
	1992	50	240	4.80	1.18	8.34	12.00	80	105	1.31	0.26	2.31	3.28
	1993	75	935	12.47	2.16	18.69	31.17	40	310	7.75	1.81	11.48	19.38
	1995	14	146	10.43	2.36	8.83	26.07	16	211	13.19	2.30	9.22	32.97
	1996	32	109	3.41	0.79	4.49	8.52	10	14	1.40	0.70	2.22	3.50
	1997	51	263	5.16	1.16	8.28	12.89	20	136	6.80	1.36	6.09	17.00

Table 1 (contd.)

		800 m from shore						1400 m from shore					
		Total	Number birds				Total	Number birds					
Section	Year	no. of segments	Total	Mean	S.E.	S.D.	Density (per km^2)	no. of segments	Total	Mean	S.E.	S.D.	Density (per km^2)
BLTR	1989	7	1	0.14	0.14	0.38	0.36	0	--	--	--	--	--
	1991	20	60	3.00	0.93	4.15	7.50	20	76	3.80	1.44	6.42	**9.50**
	1992	30	156	5.20	1.91	10.46	13.00	34	110	3.24	0.95	5.53	**8.09**
	1993	104	472	4.54	0.67	6.85	11.35	47	96	2.04	0.42	2.88	5.11
	1994	39	191	4.90	1.01	6.33	12.24	35	78	2.23	0.84	4.98	5.57
	1995	77	538	6.99	0.86	7.57	17.47	27	128	4.74	1.68	8.74	11.85
	1996	81	188	2.32	0.41	3.69	5.80	51	24	0.47	0.12	0.86	1.18
	1997	94	538	5.72	1.05	10.19	14.31	80	169	2.11	0.42	3.79	5.28
TRMR	1991	6	33	5.50	2.36	5.79	13.75	6	32	5.33	4.38	10.73	13.33
	1992	19	176	9.26	1.76	7.69	23.16	16	64	4.00	1.23	4.91	10.00
	1993	12	113	9.42	2.52	8.73	23.54	24	81	3.37	1.17	5.74	8.44
	1994	12	68	5.67	2.40	8.30	14.17	11	63	5.73	1.10	3.66	14.32
	1995	20	60	3.00	0.64	2.85	7.50	23	83	3.61	1.00	4.78	9.02
	1996	37	84	2.27	0.47	2.86	5.68	38	86	2.26	0.47	2.89	5.66
	1997	29	167	5.76	1.90	10.21	14.40	33	97	2.94	0.63	3.62	7.35
KRHB	1990	27	55	2.04	0.50	2.62	5.09	28	23	0.82	0.26	1.39	2.05
	1991	151	407	2.70	0.36	4.40	6.74	144	269	1.87	0.23	2.76	4.67
	1992	56	163	2.91	0.43	3.24	7.28	54	105	1.94	0.57	4.16	4.86
	1993	101	212	2.10	0.43	4.28	5.25	116	129	1.11	0.20	2.13	2.78
	1994	28	29	1.04	0.32	1.69	2.59	24	21	0.88	0.28	1.39	2.19
	1995	50	86	1.72	0.32	2.26	4.30	59	77	1.31	0.33	2.51	3.26
	1996	103	99	0.96	0.16	1.66	2.40	91	44	0.48	0.11	1.03	2.21
	1997	168	242	1.44	0.18	2.36	3.60	140	154	1.10	**0.21**	2.51	2.75
HBTB	1989	44	186	4.23	0.63	4.21	10.57	41	100	2.44	0.44	2.83	6.10
	1990	61	221	3.62	0.75	5.89	9.06	62	151	2.44	0.53	4.20	6.19
	1991	32	113	3.53	0.65	3.67	8.83	34	64	1.88	0.39	2.28	4.71
	1992	24	34	1.42	0.55	2.70	3.54	22	26	1.18	0.42	1.97	2.95
	1993	27	42	1.56	0.60	3.11	3.89	40	23	0.57	0.27	1.72	1.44
	1994	8	20	2.50	0.89	2.51	6.25	10	11	1.10	0.57	1.79	2.75
	1995	20	46	2.30	0.58	2.58	5.75	16	17	1.06	0.36	1.44	2.66
	1996	64	56	0.88	0.18	1.44	2.19	56	6	0.11	0.56	0.37	0.27
	1997	60	154	2.57	0.52	4.02	6.42	56	124	2.21	0.38	2.84	5.54
TBFC	1990	10	36	3.60	2.03	6.43	9.00	0	--	--	--	--	--
	1991	60	252	4.20	0.94	7.27	10.50	63	143	2.27	0.42	3.34	5.67
	1992	49	82	1.67	0.31	2.17	4.18	57	110	1.93	0.43	3.25	4.83
	1993	66	136	2.06	0.35	2.84	5.15	73	59	0.81	0.19	1.66	2.02
	1994	27	69	2.56	0.72	3.73	6.39	16	16	1.00	0.55	2.19	2.50
	1995	40	100	2.50	0.80	5.06	6.25	23	30	1.30	0.42	2.03	3.26
	1996	80	43	0.54	0.11	0.99	1.34	61	20	0.33	0.09	0.07	0.82
	1997	79	182	2.30	0.45	3.97	5.76	92	128	1.39	0.24	2.27	3.48

Table 1 (contd.)

Section	Year	800 m from shore: Total no. of segments	Number birds: Total	Mean	S.E.	S.D.	Density (per km²)	1400 m from shore: Total no. of segments	Number birds: Total	Mean	S.E.	S.D.	Density (per km²)
FCCM	1990	1	0	0.00	--	--	0.00	0	--	--	--	--	--
	1991	8	7	0.88	0.64	1.81	2.19	7	4	0.57	0.57	1.51	1.43
	1992	13	30	2.31	0.84	3.01	5.77	12	0	0.00	--	--	0.00
	1993	11	17	1.55	0.43	1.44	3.86	11	8	0.73	0.45	1.49	1.82
	1994	2	3	1.50	0.50	0.71	3.75	1	0	0.00	--	--	0.00
	1995	9	2	0.22	0.15	0.44	0.56	3	0	0.00	--	--	0.00
	1996	5	3	0.60	0.60	1.34	1.50	5	0	0.00	--	--	0.00
	1997	7	40	5.71	3.92	10.37	14.29	8	1	0.13	0.13	0.35	0.31
CMSC	1991	40	55	1.37	0.54	3.40	3.44	48	5	0.10	0.10	0.72	0.26
	1992	50	72	1.44	0.51	3.62	3.60	55	13	0.24	0.10	0.72	0.59
	1993	26	13	0.50	0.16	0.81	1.25	24	0	0.00	--	--	0.00
	1997	51	39	0.76	0.54	3.82	1.91	31	8	0.26	0.15	0.86	0.65

[a] **ORPS** = Oregon border to Point Saint George; PSCB = to Crescent Beach; CBNC = to Nickel Creek; NCKR to mouth of Klamath River; KRBL = to Big Lagoon; BLTR = to Trinidad; TRMR = to mouth of Mad River; **MRHB** = to Humboldt Bay; HBTB to Table Bluff; TBFC = to False Cape Mendocino; FCCM = to Cape Mendocino; and **CMSC** = to Shelter Cove.

6/03/97

Table 2. Designated Critical Hebitat by State, 0wnership;and Land Allocation

Washington	*Hectares*	*Acres*	*% of Critical Habitat*
Federal Lands			31
Congressionally Withdrawn Lands	740	1,800	
Late-Successional Reserves	485,680	1,200,200	
Non-Federal Lands			
State Lands	172,720	426,800	11
Private Lands	1,020	2,500	<1
Oregon			
Federal Lands			34
Late-Successional Reserves	541,530	1,338,200	
Non-Federal Lands			
State Lands	70,880	175,100	4
County Lands	440	1,100	<1
Private Lands	350	900	<1
California (Northern)			
Federal Lands			12
Late-Successional Reserves	193,150	477,300	
Non-Federal Lands			
State Lands	71.040	175.500	4
Private Lands	16,360	40,400	1
California (Central)			
State Lands	14,080	34,800	1
Countv Lands	3,230	8,000	<1
City Lands	400	1,000	<1
Private Lands	1,720	4,200	<1

TABLE 3

Pacific Lumber HCP
Summary of Old Growth Redwood and HCP Status
Area in acres

	Other	OG Doug Fir	REDOG W1	REDOG w 2	REDOG w 3	All Uncut OGR	REDRSD 2	REDRSD 3	All Residual	All OGR	Total Area
PL Lands											
Avail for Harvest	176,225	8,304	203	217	81	501	264	8,057	8,321	8,823	193,352
Buffer Zones											
buf1320	1,632					0		205	205	205	1,837
buf300	331					0		90	90	90	421
MCA Options											
Grizzley	410		73	44		117	48	482	530	647	1,057
Owl Crk	350	19	240	77		317	10	230	239	556	925
MCA Reserve											
Allen Crk	740		267	68	59	393	20	575	595	988	1,729
B Rd 7&9	232				21	21	14	224	239	260	492
Bell Lawrence	187		315	24		339		107	107	446	634
Booths Run	403	166				0	1	215	216	216	784
Cooper Mill	307					0	151	245	397	397	704
Elkhead Residual	286					0		65	65	65	351
LNF Elk	214					0	36	201	237	237	451
Rd 3	189					0	19	355	374	374	564
Rt Rd 9	128		71		6	77		112	112	190	318
Shaw Gift	162	31	250	6		255		54	54	310	503
MCA reserve Subtotal	2,849	197	902	98	86	1,087	242	2,155	2,397	3,483	6,529
All HCP (Keep Grizzley)	5,222	197	976	142	86	1,204	290	2,931	3,221	4,425	9,844
All HCP (Keep Owl)	5,162	216	1,142	175	86	1,404	252	2,679	2,931	4,334	9,712
Headwaters	1,927		2,288	584	245	3,117	0	664	665	3,782	5,709
PL TOTAL	183,724	8,519	3,706	1,021	413	5,139	565	11,882	12,447	17,586	209,830

TABLE 4

Pacific Lumber HCP

All Old Growth Redwood Area, and Lower and Higher Occupancy Weighted Estimates of Take in Context

Effective Occupied Habitat (acres, rounded) and Harvest as %-of Context

			Occupancy Weighted Estimate			
	All OGR		Lower Estimate		Higher Estimate	
	Acres	Harvest %	Acres	Harvest %	Acres	Harvest %
Subject to Harvest	9,400		3,200		4,600	
Context						
PL Not HW	13,800	68.1%	5,500	58.2%	8,600	53.5%
All PL	17,600	53.4%	8,800	36.4%	12,400	37.1%
Southern Humboldt	41,200	22.8%	17,900	17.9%	21,600	21.3%
California	90,500	10.4%	67,200	4.8%	70,900	6.5%
MMCZ 4	147,800	6.4%	124,500	2.6%	128,200	3.6%
Three State	700,000	1.3%	700,000	0.5%	700,000	0.7%

Subject to Harvest — Assumes Option Cut Owl Crk; Does not subtract areas within watercourse protection zones.
All OGR — Lumps Uncut and Residual OGR forest types (Case 6)
Lower Estimate — Reflects 35% habitat quality weighting for Residual OGR (Case 5)
Higher Estimate — All PL Uncut is 100% occupied: State Park Uncut not w/in ½ mi of occ survey is 25% (Case 3)
Area of MMCZ4 includes 44,727 acres from Coos Bay BLM District.
Area for Calif. and MMCZ4 adjusted to account for different contribution from Southern Humboldt